

## INSTITUTION VISIT TO MORRIS MOTORS.

OVER four hundred members, including 20 members of Council, took part in the Institution Visit to Morris Motors, Cowley, on Tuesday afternoon, July 19, 1938. They were entertained to luncheon and tea at the Morris Club by the President of the Institution, Viscount Nuffield, who, at the reception prior to the luncheon shook hands cordially with each of his numerous guests.

In a brief speech of welcome, Lord Nuffield said how gratified he felt that his invitation to the members of the Institution of which he was proud to be the President had brought so many of them to Cowley.

Sir Walter Kent, Past-President, on behalf of all present, thanked Lord Nuffield for his hospitality and for the opportunity of seeing the Morris Works under such excellent auspices.

Following a tour of the works, tea was served, at the conclusion of which Mr. J. H. Bingham, Chairman of Council, conveyed the thanks of members to the Directors of Morris Motors.

On Mr. Bingham's suggestion, as a small token of appreciation of what the President had done for the Institution, a collection was made on behalf of whatever charity Lord Nuffield wished to name. The collection amounted to £35 6s. 6d., which Lord Nuffield decided to give to Guy's Hospital Appeal Fund.

Later, in sending the thanks of the Governors of Guy's Hospital, their Appeal Secretary mentioned that the gift was worth over £70, as King Edward's Hospital Fund had just promised to double whatever donations Guy's were able to secure up to the end of the year over and above their previous income.

Every Section of the Institution was represented on the visit, from Glasgow and Edinburgh, in the North, to the Southern Section, at Southampton, and from the Eastern Counties Section, at Ipswich, to the New Cornish Section in the West. While London Section, with 157, headed the list, 87 came from Birmingham, 38 from Coventry, over 30 from the Western Section, 20 from Leicester, more than that number from Manchester and Preston Sections, 16 from Yorkshire and 13 from the Sheffield Section. The Sydney Section, Australia, was represented by its President.

The Members of Council present were: Sir Walter Kent, Mr. J. H. Bingham, Col. L. Sadler, Messrs. J. H. Barber, J. W. Berry, F. L. Daniels, H. W. Denny, H. A. Drane, R. C. Fenton, G. H. Hales, F. W. Halliwell, J. A. Hannay, B. C. Jenkins, L. H. Leedham, E. C. Parkinson, W. Puckey, T. C. L. Westbrook, F. Williams, and R. H. Youngash.

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## WORKS MANAGEMENT IN A SMALL FACTORY

*Paper presented to the Institution, Edinburgh, Glasgow,  
Western, and Yorkshire Sections, by T. G. Rose, M.I.P.E.,  
M.I.Mech.E., F.I.I.A.*

I HAVE approached this subject with a great deal of interest, since it enables me to draw attention once again to the immense importance of the small industrial undertaking in this country—or, for that matter, in any country. Those who write books and give addresses in connection with management subjects almost always deal with the problems of the large undertaking. I have never quite been able to understand the reason for this. It may partly be due to the fact that an executive in a large undertaking has more time to spare than his opposite number in a small business, and therefore is more prepared to put time into the preparation of a paper. Possibly it may be caused by the erroneous belief that it is more difficult to organise a big place than a small one. Again it may be that those who hold positions in big concerns have often held other lesser staff posts elsewhere previously, and are therefore more qualified to compare what they see going on around them with the faults and failings that they observed in their earlier jobs. Whatever reason there may be for it, it is certainly to be regretted, and I should like to see a series of annual prizes offered by some benevolent individual for the best practical papers dealing with industrial problems as they affect the small concern, whatever its particular trade or business may be.

Perhaps I may be permitted to quote once again from the figures relating to industrial undertakings of various sizes in this country. They are the latest available, although for the year 1933, and are taken from the 1934 Annual Report of the Chief Inspector of Factories and Workshops, Table 12.

These statistics, I have found, often come as a great surprise to the individual who has not given much thought to it before. He is accustomed to seeing references in the press to the large firms in industry; he reads the speeches of the chairmen of some of the biggest undertakings at their Annual General Meetings, and he forms a kind of vague belief that industry consists of large concerns with huge workshops and factories employing thousands of individuals in mass-producing goods of all kinds. To learn that out of a

*Edinburgh, 16 March; Glasgow, 17 March; Bristol, 18 February; Leeds, 28 March, 1938.*

# WORKS MANAGEMENT IN A SMALL FACTORY

## DISTRIBUTION OF FACTORIES ACCORDING TO SIZE—1938. All Industries

Size Group	Factories *	Persons Employed										Total
		Males					Females					
		Under 18 years of age		18 years of age and upwards		Per Cent. of Total	Under 18 years of age		18 years of age and upwards		Per Cent. of Total	
		No.	Per Cent. of Total	No.	Per Cent. of Total		No.	Per Cent. of Total	No.	Per Cent. of Total		
1-25	103,989	77.8	66,280	10.0	431,374	65.4	33,175	5.0	129,339	19.6	660,168	14.0
26-50	11,479	8.6	31,079	7.6	230,647	56.0	32,257	7.8	117,665	28.6	411,648	8.7
51-100	8,133	6.1	37,649	6.6	299,483	52.7	50,527	8.9	180,263	31.8	567,922	12.1
101-250	6,460	4.8	63,769	6.3	516,960	50.8	93,054	9.1	343,743	33.8	1,017,526	21.6
251-500	2,307	1.7	47,224	6.0	400,436	50.4	74,164	9.3	272,056	34.3	793,880	16.9
501-1,000	880	0.7	35,799	5.9	318,208	52.7	57,313	9.5	192,944	31.9	604,264	12.9
1,001 and upwards	335	0.3	36,323	5.6	404,965	62.4	44,494	6.9	163,164	25.1	648,946	13.8
Grand Total	133,583	—	318,123	6.8	2,602,073	55.3	384,984	8.2	1,399,174	29.7	4,704,354	—

\* The grand total is confined to factories which have made Returns showing persons employed during the year.

**EREWHON ENGINEERING CO. LTD.**

MR. BROWN, *Chairman and Managing Director*  
MR. ROBINSON, *Works Director*  
(Three other Directors, part-time advisory)

**Division of Responsibilities for the Six Management Functions :**

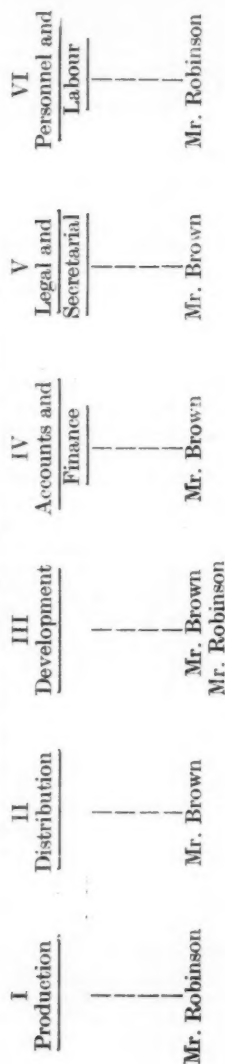


DIAGRAM I.



total of 133,583 places making returns under the Factory Act, only 0.3% employ more than 1,000 operatives is a severe shock, and it is even more of a shock to learn that 77.8% of the total employ less than 25. Yet there is many a sound and admirable little business employing 25 persons to-day, giving a livelihood and security to those who work in it, and establishing quietly a goodwill through which it might in another ten years' time grow to the 250 or even 500 employee level. We are, I think, a little too apt to forget that the little firm of to-day, struggling with its back to the wall, with an owner-manager working sixteen hours a day to pull it through, may perhaps be the large and prosperous undertaking of the next generation.

I am glad, therefore, to have the opportunity of putting before you to-night my suggestions with regard to works management in a small concern. I have taken the opinion of a number of people with regard to the definition of the small concern, and putting all the opinions together I suggest that we consider a business having approximately 200 employees, all told, manufacturing medium to light engineering goods in batches up to a maximum of 50, but most batches being in the neighbourhood of 10 to 20. Service work is done of an irregular nature, and a certain amount of one-off jobs are taken as well, these last at a good profit.

Diagram I shows the distribution of the working responsibilities. The senior management consists of two working directors; one, who ranks as managing director, looks after the sales and the market development work; we will call him Mr. Brown, and he will also supervise the accounts and finance, and the legal and secretarial work, having directly under him the accountant-secretary of the company. The second working director, Mr. Robinson, takes entire charge of all production affairs, including the purchasing of material.

May I break off here to say that I am very well aware that there are innumerable ways of distributing the duties in a small concern. It is often a great advantage for the works manager to have the drawing office directly under his own control, as he is then able to ensure that the drawings are issued when he wants them, and that no delay is caused by the non-receipt of general arrangements and assembly drawings, or by the schedules not being got out promptly. On the other hand, in a small works, the works manager is more often the senior foreman type, a sound engineer with a good working knowledge of handling the tools and dealing with his men, but with no pretensions towards skill in design or knowledge of the strength of materials. May I be allowed, therefore, to choose for the purpose of this paper the type of concern where the works director, Mr. Robinson, has an active interest in the design of the products and the technical knowledge necessary to ensure their proper development

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ORGANISATION

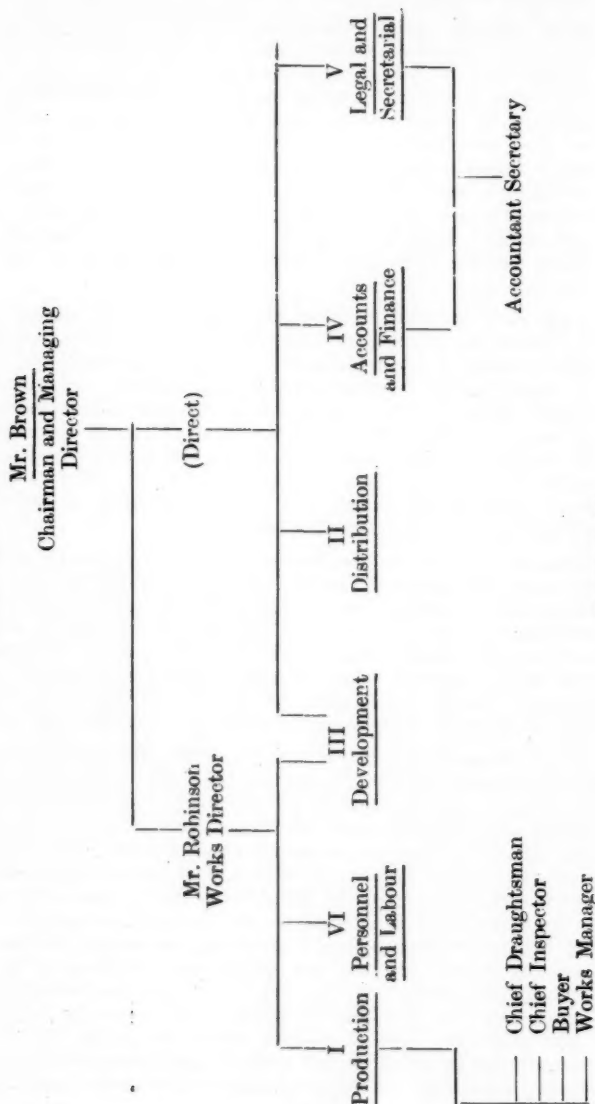


DIAGRAM II.

in collaboration with the managing director's commercial development work. In such a case the chief draughtsman would act as his personal assistant in getting out new designs, and in so small a works there should be no difficulty in the works manager making it clear to the chief what he wants, and when he wants it, if delivery dates are to be kept.

In the shops there would be a machine shop foreman, a fitting and assembly shop foreman, with a number of working charge-hands, and in addition a full-time charge-hand inspector who would be answerable directly to the works director for the quality of the goods delivered. The chart of the organisation would therefore be as in Diagram II. This should be sufficient, I think, to set out the type of works that we are going to discuss, although we might perhaps give it the benefit of modern buildings, with sound floors and roofs, and adequate lighting, heating, and ventilation. I am well aware that only the modern small concerns can show working conditions of this kind, but we need not, I think, complicate our discussion by considering tumble-down old buildings on several floors, with bad lighting, worse heating, and no ventilation at all, except draughts.

In 1932 I gave a paper before the Institute of Industrial Administration entitled "The Management Audit." This was subsequently published in booklet form, and has continued to enjoy a small sale ever since. In that paper I endeavoured to demonstrate that it was possible to audit a concern for management by means of a survey of its organisation and methods carried out by an individual of experience. No doubt it would be much easier to audit a firm's accounts than its management methods, since accounts depend upon a fixed set of established rules. Management is largely dependent upon the personal element, so that only certain main principles can be set out with safety. I thought, however, that as I had made a profession of faith in this matter six years ago, it would be only logical to go through the management of the small factory that we are about to discuss as if I were making a management audit. By so doing I can put before you for your consideration the kind of things that I should look for—things which, in my opinion, would show whether the place was properly managed or not.

I do not wish it to be thought by any of you here to-night that I suffer from the delusion that I know more about management than you do. I can certainly claim to have had a close practical acquaintance with the detail problems that arise in a works as a shop manager, production manager, and works manager, followed by a period of ten years in which I had a practice as an industrial consultant, dealing with the difficulties of industrial undertakings of all sorts, sizes, and types. I know that there are many points in works management upon which two opinions, diametrically opposed, can

both be right, and moreover—with some small change in external conditions in a different works—those opposite opinions might both be wrong. In works management, as, I suppose, in most other things in life, the old saying of Marcus Aurelius still holds good, “All things are done with reference to circumstances; judge not, therefore, unless thou knowest those circumstances.” I hope, therefore, that none of you will arise in wrath and slay me during the discussion for apparently offering what might be misleading council from your own particular standpoint. I shall try to avoid, as far as I can, contentious points, and keep to matters which I think I might be permitted to describe as safeguarding duties.

As we are dealing to-night with works management in a small concern I do not propose to refer in any way to the duties of Mr. Brown, the managing director. I intend to deal only with Mr. Robinson, the works director, and his activities in the factory. He handles directly, as the diagram shows, the chief draughtsman, the chief inspector, the buyer, and the works manager. Let us take each of these in turn, and see what is likely to arise in connection with their duties.

### **The Chief Draughtsman.**

In most small drawing offices the preparation of finished drawings or traced negatives is avoided as far as possible, on account of expense and the length of time involved. On the other hand, certain conditions must be fulfilled if efficient work is to be achieved:—

(a) Properly dimensioned drawings must be got into the shops with the least possible delay after a customer's order has been received.

(b) A record must be kept of all drawings sent into the shops and an original of some kind retained in the drawing office.

(c) If it is in any way possible the principle of one part one drawing should be observed in order that part numbers and drawing numbers can be the same.

Much time can be saved by dimensioned pencil hand-sketches or ordinary line drawings made in duplicate sketch books of standard sizes. The top copy can be sent into the shops, the duplicate remaining fixed in the book, and the life of the top copy can be considerably lengthened by the edge of the paper being reinforced with a small band of adhesive tape put on by a special machine which is sold for the purpose. The principal difficulty with tracing paper in the shops is that it tears so easily; but if the edge is reinforced in this manner it is impossible for tears to start at the edge, and it is only on rare occasions that the damage occurs in the centre.

There is also a process which has just been brought out by which drawings can be laid down on cheap millboard and glazed by a hot pressing process, the drawing being ready for use in a few minutes.

In works where it is the custom to put standard drawings on mill-board before issue to the shops this avoids the lengthy process of pasting down, sizing, and varnishing, with the subsequent bending of the mill board due to shrinkage.

It is seldom that there is much time to spare for general arrangement drawings in small works drawing offices. I should like, however, to insist upon the paramount importance of adequate and accurate part schedules, as they are the foundation of so much of the necessary work throughout the place.

It is impossible not to sympathise with the tendency to take the line of least resistance in small works where the whole of the staff usually has more work to do than they can efficiently handle. In advising clients, however, I do my best to insist that the scheduling work in the drawing office shall be thoroughly done. To my mind it is almost as foolish to send a continuous stream of drawings into the shops without the proper schedules for assemblies as it would be to send out those drawings themselves without any dimensions on them. Unless the draughtsman, when he is getting out his drawings, makes a careful list of every part, down to the smallest washer or split pin which goes to make up the completed job finally dispatched to the customer, the storekeeper will have no chance to know what he is likely to be called upon to hand out, the assembly foreman will have to run about looking for what he thinks belongs to the job, and the cost section will not have the remotest chance of getting out the true cost of the completed article. I could tell tales of drawing offices from which the schedules are issued long after the finished job has left the works, and I have come across works where the assembly foreman has had to go about stripping parts off other machines, and making frequent visits to the drawing office, or sending the draughtsmen down in the shops to find out what belongs where on the machine that he is supposed to be assembling. I do feel very strongly that the works manager of any business small or large, should insist in the firmest possible manner on the drawing office invariably issuing complete part schedules for all the assemblies that are to be found in the completed state—and, what is even more important—keeping these schedules up-to-date by alterations and modifications as they subsequently become necessary.

### **The Buyer.**

It might perhaps be as well to dispose of the duties of the buyer and the chief inspector before starting on the wider range of responsibilities which fall to the works manager himself.

It is the buyer's job to obtain what is required of the right quality at the right time, and to pay the right price for it. I would ask you to note that I put his responsibility for paying the right price last

because in my opinion that is the least important matter of all. I take for granted that the buyer tackles the price problem from what one might call a professional standpoint—that is, that he knows what is the reasonable price that he should pay for the class of goods that he is buying, and he makes sure that the firm does not pay more in the end for that material than has been allowed for in the original estimate when the selling price was made up. But sound quality and reliable delivery are of much greater importance than the actual figure of price that stands on the buying order. From time to time in my past experience I have had to deal with a “keen” buyer, a man whose one idea about buying is to obtain the lowest possible price that he can, with only the most perfunctory regard to quality and delivery. A man of that type will play one quoting firm against another, will dangle possible future orders in front of the salesman, and having got a price for 1,000 off will offer an order for 100 at the same price, or even less. If he can manoeuvre the seller into a bad position, into being almost forced to take the order at an uneconomical price, he rubs his hands under the impression that he has done a stroke of good business. He has never learned what always seems to me an elementary truth—that the buyer is *always* in the hands of the seller whether trade is good or bad. The “keen” bargain which cuts the seller’s price to the bone and leaves him little above his overheads inevitably has the same result. The seller will use the lowest quality of material that will pass inspection; he will cut down the work upon it to the absolute minimum, and, what is sometimes far more aggravating, he will relegate the order to the background, and only work on it when more profitable jobs are not available. To frantic appeals for delivery he will return courteous explanations of all kinds. Finally when the batch has been received, sometimes quite a number will be found to be faulty from one cause or another, even though they have passed the inward inspection for physical tests and superficial examination. The buyer, no doubt, can point with pride to the fact that he has made a saving of £100 on this order compared with the last order placed with a different supplier for similar goods. The cost to the firm as a whole, however, in tools, wasted labour on the machines, and general disorganisation caused by late delivery and waiting for replacements, may be many times what he thinks he has saved by his keen buying. This is particularly true with steel castings. I seldom come across a buyer who seems to be able to grasp that economy in buying steel castings is an extremely dangerous and wasteful procedure.

I would have the buyer inspect each week any faulty material that comes to light, and make a weekly report to the works director on it, with the names of the suppliers and the reasons for rejection. This, I think, is particularly necessary in a small business, because

A small concern can seldom order much quantity of material at a time for financial reasons as well as output reasons, and consequently the buyer of a small concern should carefully develop a range of suppliers of a small but reliable type, more or less equivalent to his own concern in their own particular line. To place an order for 100 stampings in some large stamping plant, working continuously on large batches for the big engineering concerns, is bound to lead to disappointment in the matter of delivery, and the same may be said of most commodities. The buyer of the small factory, therefore, should remember that his problem is of a rather special nature, and should do his best to build up a goodwill amongst the suppliers with factories of about his own size.

There is one further point in connection with the buyer which I might perhaps put before you. That is that the buyer should keep in very close touch with the accountant, and the accountant should listen with a sympathetic and helpful ear to the buyer's advice and information. Prompt payment of accounts amongst small businesses is a very great aid to good service, and the fact that an account is invariably paid on the fixed payment date goes a long way towards obtaining preference in the matter of supplies.

Most small businesses are prone to over-trading. I hope that one day there will be a Royal Commission set up to investigate the small industrial undertaking, and to put forward proposals for finance or for assistance of one sort or another to encourage and assist the small undertaking to grow to a healthy but not excessive size. Most small businesses are for ever short of cash, especially when trade is good and there are many orders to be had. The cashier, or accountant, therefore, should keep very closely in touch with the buyer, in order to ensure that cheques are sent to the suppliers whose goods are most urgently needed, and that orders are not placed with suppliers who are known to be troublesome in this respect.

### **The Chief Inspector.**

With regard to the chief inspector, this is, perhaps, rather a grandiloquent title for the small concern, however usual it may be in a large one. I am afraid that in many small factories inspection is rather a nominal affair. Only too often it is left entirely to the foreman to inspect and pass the goods that are despatched, but in a factory of about 200 employees such as we are speaking of to-day, there should certainly be one responsible individual charged with the duty of inspecting the goods before they are finally despatched to the customer. The number of men necessary to carry out this inspection work will naturally depend upon the class of work done. In certain types of manufacture a factory of 200 employees might well require a staff of half-a-dozen inspectors, or perhaps a couple of male inspectors and a number of girls. It is impossible to lay down



any rule for actual size of an inspection department, but the main thing to hold on to is that some one individual must be responsible to the managing director for the quality of workmanship and the standard of finish of the goods sent to the customer.

I often feel, as in the case of the store-keeper of whom we shall be speaking later, that the works manager of the small factory sometimes overlooks the very great help that a good inspector can be in assisting the successful running of the business. To be a good inspector is a gift not possessed by many individuals, but those who have had experience of really good men of this type will agree with me that they are a stand-by of no small value, even though their position and their salary may be a humble one.

Some men possess a strange gift of knowing instinctively whether something will matter, or whether it will not, in relation to the subsequent service that the article is going to perform. If a certain part has been turned or ground under-size to drawing, the question as to whether it should be scrapped or not obviously depends upon whether the error is going to matter or not in the subsequent functioning of the job. Sometimes a quarter thousandth means the scrap heap, and sometimes an eighth of an inch makes not the slightest difference. Each case must be judged on its own merits with careful regard to the problem of future interchangeability of spare parts. Most of us have had to face the problem of a particular batch wrong to drawing through some trivial error. The parts, if fitted, will function without the slightest drawback, but it means that when spares are called for the standard part will not fit. This will entail a special record being made of every machine into which this particular batch goes, and, further, the retaining of a certain number of these parts to which a special part-number will have to be given in the service section of the stores. In short, that batch takes on what might be called a nuisance-value which is far larger than the intrinsic value of the batch expressed in terms of material, labour, and factory overheads. Often the wisest course is to scrap it mercilessly, in spite of the irritation of seeing so much good material thrown away.

The obvious comparison for the inspector of the small factory is that of the watch-dog, and if I were to enumerate the qualities that I should like to see in him you would probably feel that I was describing an individual who could not possibly exist. I think, however, it might suffice for to-night if I emphasised once again that I feel most strongly that no small factory should be without at least one responsible and experienced individual whose duty it is to watch over the standard and quality of the goods manufactured, from every aspect, and to report direct to the works director with regard to any point that comes to his attention, liable to cause, in his opinion, damage to the company's goodwill.



You may perhaps question my remark that he should be answerable directly to the works director. I think it is an established principle to-day that the man in charge of the production should not have the ultimate authority over the man in charge of the inspection. If the works manager is more of the foreman type it will probably be best for chief inspector and works manager both to report direct to the managing director. If, on the other hand, the works manager is of the senior type, well able to hold the balance between production and inspection, then there is no reason why the chief inspector should not report direct to him, and free the managing director from this responsibility. It all depends on the nature and temperament, the outlook and the character, of the works manager in the particular factory.

### **The Works Manager.**

Having disposed of the chief draughtsman, the buyer, and the chief inspector, we can now pass on to the individual who carries most of the babies, that hard-working greatly driven, and much harassed individual known as the works manager. I have been one myself, and I have a strong sympathy with all those who carry the many burdens of the post—burdens of so varied a nature and so perpetually renewed.

It will perhaps assist matters if we split up the works manager's normal duties into a few main categories. Broadly speaking, he will have to deal with: (a) planning; (b) process; (c) storage; (d) despatch; (e) plant and buildings; (f) personnel and labour; (g) general. Let us deal with each of these in turn:—

### **Planning.**

Under this heading I include all the non-technical production side of the work; that is, the receiving of delivery programmes, the planning of the work through the shops from the receipt of the material to the despatch of the finished goods, the making of machine or foundry programmes, and the provision of some effective progress system by which the conduct of affairs can be watched.

This is a side of small factory management which is only too often greatly neglected. In my consulting work I have been again and again brought up against the fact that whilst this Institute encourages in every way the development of the technical production engineer, the man of high engineering skill in tools and processes, there is no body which develops and encourages the non-technical production man, the organiser with a technical background, who ensures the smooth running of the place and without whose efficient work the economies effected by the technical production engineer come to nothing. I have found it most difficult to obtain good plan-

ning men for my clients, and I have yet to learn that any efforts are being made by any society or institute to develop these men.

Yet a good planning man can be one of the most important factors in the running of the place, and can take a very large proportion of the works manager's worries off him. He must be an individual with a strong leaning towards organisation and method. He must have a good memory, a capacity to pick up rapidly the relative length of time occupied by different processes, and, above all, he must possess that curious sixth sense which seems to warn him that something is liable to go wrong unless he forestalls it by action of some kind. Men of this type are to be found in the lowest ranks of engineering, men who, with a modicum of training, can do admirable work, without trespassing in any way on the technical field of the foreman. I would say that every small factory should have its planning man, and there are many duties which he could undertake so that he may earn his salary many times over.

With regard to his work itself, first and foremost there should be in every factory a monthly output programme, drawn up about the third week in the month to cover the following month's activities. To those who would say that "Our business is different, and we cannot make our delivery programmes on account of the rapidity of our turnover and the uncertainty of what we are going to deliver" I would reply that you are in charge of a small undertaking which has a certain net worth—i.e., a certain sum made up of the issued capital, the general reserves, and the carry-forward on the profit or loss account—which is employed in the business. If your business is being properly run this net worth should bear at least  $12\frac{1}{2}\%$  profit each year, and it is therefore a simple matter to calculate that the approximate percentage of profit derived from your range of goods sold to obtain  $12\frac{1}{2}\%$  on your net worth entails a sales turnover of not less than so much per annum. That, incidentally, is the first stage in higher control, a method of presenting the facts and figures of a business which I would recommend you to study, as it is the only means yet devised by which the owner or manager of a business can really see clearly what is going on.

Having arrived at the necessary sales turnover, that can be divided by twelve for normal businesses, or any agreed ratio for seasonal businesses, and we then have a minimum monthly programme of output which must be obtained if the business is to function securely.

The next stage is to settle how that minimum monthly turnover is to be made up, and this is where we come back to the monthly programme. If a small business is to be a success everyone in the organization must work enthusiastically to a common end, and that common end should be a quite public and open figure of turnover desired for the month, known by everyone in the place from the

managing director to the office boy, and serving as a bogey against which the whole team is playing. If, for some reason, it is not desired that all and sundry should know the sales value of the goods delivered, there is a little difficulty involved in roughly estimating the factory cost value which can be used in marking up the results—or, better still, physical units can be used in some businesses. Those who have had experience of working with output barometers of one kind or another—sometimes a board upon which output for the previous day is posted, together with the cumulative output for the month that has already elapsed; sometimes a giant clock-face with the red hand set to the point which it is desired to reach, and the black hand moving slowly towards it—those, I say, who have worked with these methods know what an immense stimulus they have upon those employed in the business. We have, fortunately, in our national make-up, a strong dash of the sporting spirit, and it is surely only obvious commonsense to utilise that sporting spirit in our work as well as in our play.

Once the output has been fixed for the coming month the planning man will have to sit down and work out a more detailed programme showing how he is going to obtain the desired total. This may mean visits to the drawing office, the different foremen, the buyer, and so forth, all in continuous contact with the works manager, until the assembly shop foreman and the despatch department can be given a fairly definite list of what has got to be delivered during the month.

May I impress upon you at this point how much value I put upon this planned method of managing a small factory. It is perhaps a little unfortunate, as I have remarked earlier in my paper, that so many of the papers and books dealing with planning seem to handle only the conduct of large undertakings. As a result of this, the word "planning" to the works manager of the small place brings up visions of machine loading programmes, of countless instruction to different individuals, and red-tape of all types buttressed by a formidable array of paper forms. All that is rubbish. The whole point of planning is to take a point to march upon. Once that has been done the methods adopted to reach that point can entirely depend upon the size and nature of the place and the staff employed. Some form of planning there must be, however, if the small factory is to work efficiently. I personally am in favour of the monthly programme split into the normal categories of goods to which the whole factory is accustomed. As many definite customers' orders as possible should be included in the programme, and when the total value of these falls short of the monthly output desired, owing to the fact that sales are rapid and delivery is expected to be made almost from stock, the programme can be filled up with

stock items based upon the sales director's forecast of what he thinks is likely to be wanted, but modified as the month goes on.

By hook or by crook a programme must be built up to cover the required monthly turnover, and in saying this I might perhaps remark that I am taking for granted that the sales director can keep the selling side up to, or above, that normal programme figure. If orders fall short, then the question of putting goods into stock will have to be most carefully watched, lest the precious working capital should be locked up, and trouble caused later from this fact. May I point out, further, that control over the works' activities is much better kept when a programme exists than when it does not.

The planning man will have to watch the progress side very carefully. In a small business the number of individuals required for adequate progress work depends upon the class of goods manufactured. I have always stood for a method by which progress up to the end of the machine operations is controlled from the progress office, but progress from the assembly side should be controlled by progress men acting directly as assistants to the assembly shop foreman. Probably in a small concern the planning man himself would look after the sequence of work in the machine shop, and the assembly shop foreman would have one progress man acting as his personal assistant at the other end.

The point of this arrangement is that the only man who really knows what he wants in assembly work is the assembly shop foreman. You are all aware of the immense waste of time and money that can be caused from the assembly shop foreman starting work without an adequate supply of the necessary parts to ensure smooth and continuous work on the assembly floors or benches. In my experience, to make the central progress office responsible for seeing that the foreman gets what he wants when he wants it, is to ask it to undertake an impossible task. The usual result of this arrangement is that the foreman sits back and shrugs his shoulders, and hands out a list of parts for which he is waiting to the progress man on his next visit. The foreman considers that he is not responsible for his job at all until all the parts are handed over to him, either from the stores or from the machine shop, and the progress man will often grumble that the foreman has not told him about these parts being wanted until it was too late for him to make arrangements for them to be finished in time.

I submit that much the most practical arrangement is for the assembly foreman to have a progress man acting as his personal assistant. The foreman can then make his own progress man responsible for seeing that all parts are ready for him before he sets a man on to do a given job. Here again the planning will start from the monthly programme. The foreman receives this, sits down with his progress

man to go through it, and makes notes of what is going to be wanted if he is to get the output asked for. The progress man should be in close touch with everything that is going on on the assembly floor or benches, and if he is the right type of progress man—that peculiar individual whom most of you know, with an encyclopaedic memory and a mind which might be described as analytical, automatically sizing up the steps by which a job can move steadily forward, even though certain parts may be delayed—if, as I say, he has these qualities, he will be able to keep the planning man in touch with the sequence in which the work is handed from the machines, and also warn him what delays look like being caused by non-delivery of put-out finished goods.

As you know, it is frequently possible to get on with an assembly job even though the completed set of parts is not available. This, however, is a dangerous principle, since it tends to encourage muddled working. In one general engineering works of a much larger nature than the small concern which we are discussing I once came across an assembly fitter at a bench who had 55 job cards outstanding for partially completed work, due to the complete muddle that existed in the planning. Whilst red tape should not permit the work to be delayed, due to the fact that certain parts cannot be handed out from the stores along with the rest of the set, every possible effort should be made to avoid broken work of this nature, even to the extent of the assembly shop progress man making a daily return of all jobs waiting for parts.

### Process.

Under this heading I include all the technical production work, the design of jigs, tools, and tackle of all kinds, the improvement of manufacturing processes, and the recommendations for new machinery of one kind or another. Here again the small concern needs an active and intelligent engineer with a continuous effort to improve the methods in the place. A new machine will probably be a momentous event which needs a lot of discussion before it is decided upon, although in these days of credit and hire-purchase it has become much easier to obtain machinery on long-term payment whereby the economies effected by better plant will help to pay for its cost.

I do not think it is worth while elaborating this section at any great length. The need for sound process work is obvious, and the prosperity of the business will largely depend upon its manufacturing efficiency from this standpoint. One suggestion that might be put forward is that the managing director or the works manager might, with advantage, encourage his process engineer, if he has one, to move about more freely and visit other works, and to join this Institute as one way of keeping his wits sharpened. I say, "if he

has one " because it is by no means always that one man is to be found in the small concern specialising in this particular work. Sometimes jigs and tools are got out by the draughtsman who has designed the part, and sometimes machine shop foreman is expected to sketch out his own tackle and get it made for himself. In the small business where repetition work is the rule such jigs as are required are often put outside, and this is probably a sound practice, as it is seldom that a small concern can afford to run a large tool room.

On the whole I would submit that it is well worth while for the small business to have a man definitely responsible for the process side, and answerable to the works manager for this side of the job. This does not mean that the works manager cannot give instructions as to jigs and fixtures, and many works managers particularly enjoy doing this. The process man would probably have one or two junior draughtsmen under his control, and another suggestion that I should like to put forward is that he should be asked to send in to the managing director every month a statement not exceeding 10 lines in length setting out what he has done during the month to effect economies or improve the methods of manufacture.

#### **Storage.**

The storekeeper is another individual who can play a very useful and effective part in the running of the place. Far too many small factories look upon the stores as merely a place to keep things in, and the storekeeper's job as a suitable post for a pensioner who is rapidly approaching a half-witted condition. This is, of course, a relic of the old days, of the happy slow-speed times when nothing was done in a hurry, and very little record was kept of what was done. To-day the storekeeper of some firms has virtually become the production manager with a very wide sphere of control, taking a leading part in the ordering of material, the purchasing of it from outside suppliers, the issue to the shops, and the accurate keeping of stocks records in connection with the monthly accounts.

In the small concern of which we are talking, however, he would probably be a responsible individual of middle age, with a strong bent towards neatness and orderly methods. The more he can be encouraged to take an active and energetic part in what is going on, the better for all concerned, and he can help a great deal by collaborating with the progress man with regard to what is likely to be wanted in a few days' time; the buyer with regard to shortages that have suddenly arisen, or delays in delivery of stock goods for which he has requisitioned some time ago. He can also help the costing department to a considerable degree by making careful notes of miscellaneous items issued against specific jobs in cases where proper requisitions have not been made out, or bar ends and other material have been returned for credit.

As far as possible the stores should be in a convenient position both for receipt and issue of goods, and it is always advisable to have the rough material stores separated from the finished goods end where despatch is taking place.

Mention might perhaps be made of individual part stores and unit stores, which can be of very great help to the assembly shop foreman. These, however, are more in the nature of convenient storage places for the foreman than expense stores coming under the storekeeper.

The storekeeper should be allowed to have adequate lighting in his domain, and if there is one principle above all others that he should adhere to like grim death, it is to refuse to take into the current stores any obsolete, damaged, or rejected goods. These should always be kept together in a separated part of the store, preferably in a portion which can be locked up and only opened on occasions. I am afraid that a very large number of stores in small concerns would receive very bad marks if examined from the point of view of lighting, layout, hand-control, and other theoretical ideals. So many I have seen look more like marine junk stores, dark caverns with bins full of rubbish, mixed up with current stock, and odds and ends of every description lying around.

The storekeeper is certainly a man who needs encouragement, and I trust those of you who are in charge of small factories will bear in mind that he could be a very able and capable help to you if you give him the chance, and develop him to think intelligently as to how he can take his full part as a member of the team.

### **Despatch.**

I do not think we need go into the problems of the despatch section at any great length. The despatch clerk or charge-hand can certainly be of considerable assistance by building up as extensive knowledge as possible of rates, routes, and different forms of transport. He should also be adept in making use of existing crates and other packing material, and should be able to call upon the works manager for temporary additional help if he appears to be getting behind-hand with outward goods. If any export work is being done he will have to have a good all-round knowledge of foreign shipping requirements.

### **Plant and Buildings.**

Here again in the small works of 200 employees possessing an all-round output of normal engineering plant and machinery, it would certainly pay the works manager to have an experienced individual of the millwright-fitter type in charge of the plant and buildings maintenance section. In small places machinery is only too often run to death, maintenance being left until the machine actually



breaks down. This is naturally unsound, particularly as where plant is not extensive the breakdown of a single machine is apt to cause considerable dislocation in the work. It is well worth while for the works manager to enforce the keeping of a machine card index in which the original particulars of each machine are entered up, and the subsequent repairs, with their factory cost. Each machine should be looked over at least once a year, some of them more often, and the charge-hand millright should be responsible for a weekly report to the works manager with brief comments on the condition of all the machines that he has looked at during the week, including recommendations with regard to prospective overhauls.

Buildings also need watching, particularly with regard to roofs, gutters, and drains, and these also should be the subject of periodic surveys. I am well aware that matters of this kind are usually left in small works until trouble arises, but leaky roofs and flooding gutters are apt to cause more damage than it would have cost to maintain them in proper condition.

There is one point which might be made before we leave the question of plant maintenance, and that is that in small concerns the major machines in the place usually become by degrees almost the personal property of the men who have worked on them for years. Under such conditions the men are accustomed to take a pride in the condition of these machines, and there is therefore much more chance that they will be cared for than where two or three shifts are permanently worked, and the machines merely become pieces of mechanism through which the maximum weekly pay packet can be obtained.

### Personnel.

It is too much to expect the small concern of which we are speaking to have a separate individual responsible solely for the engagement and discharge of labour, and all those matters which usually come under the heading of internal welfare. May I suggest, however, that the fact that a full-time individual cannot be afforded does not mean to say that the *duties* cannot be quite effectively carried out by a number of individuals. It depends upon who is available, and it is my experience that in small works there are often to be found men who take a real interest in helping their mates, and such men are usually ready to look after first-aid arrangements, visit absentees by special request, and such-like personnel service. If there is a canteen it will probably be run by a works committee, but this is such a very debatable subject that I hesitate to give an opinion on it to-night.

The actual engagement and discharge of labour will probably be carried on by the foremen themselves on the old lines, though if



the time clerk, or even the cashier, is a suitable type, it is a great convenience to have one man through whom applications can be made to the local Labour Exchange, and who discusses any matters raised by the shop stewards or any of the operating personnel, before the affair goes before the works manager officially. I do not think I can say more on this particular section to-night than that the whole question of relations with operating labour is, in my opinion, going to become important in the future. The wise works manager of a small factory, therefore, will do what he can to build up some channel through which it is easy for his operating staff to put matters before him without going to the formal step of an official deputation. Much can be done towards smoothing over minor difficulties if discussions take place through a third party at an early stage in the proceedings.

### General.

Passing now from the detail sections of a works manager's responsibilities to the more general ones—and these are perhaps the ones in which you, gentlemen, will take the greatest interest—as I see it, one of the first duties of the works manager of a small concern is to have an adequate set of figures to keep him in touch with what is going on. This brings us straightway up against the problem of costing and control of expense, and here you will perhaps pardon me if I assume that the concern in question will be preparing its figures regularly every month on the higher control method, for it is precisely in the small factory of this kind that higher control work can be most valuable.

For those who have not heard of the method before, I should explain that higher control is carried on by arranging the facts and figures of a concern under three headings—business, trading, and financial. The business section takes charge of the orders received, the orders outstanding, and the orders invoiced; the trading position presents a statement of account in which the various classes of expenditure are deducted, one by one from the sales turnover, each in its management sequence, until the final profit or loss for the month or for the period is shown at the bottom of the sheet. The financial position deals with a few simple facts, such as the ratio between debtors and creditors, the working capital, and so forth, and the whole method is so interlocked that nothing of any importance can take place within the concern without it showing on the trend curves kept. It has been in use for nearly ten years now in various industrial undertakings, and it requires no extra staff whatsoever to keep it up. It cannot be installed unless the books of account are properly kept, and the only burden that falls upon the accountant when working on the higher control system is some rearrangement, usually insignificant, of the headings under which the various expenditures are segregated.

You may suggest that the items which I have enumerated are more the concern of the managing director than of the works manager. I quite agree that the management of the company as a whole by means of the higher control reports and figures is the business of the managing director, but the works manager is vitally concerned with the order received, the orders outstanding, and the orders invoiced (or sales turnover), and he is equally concerned with the first portion of the statement of account, between the figure at the head of the sheet for sales turnover and the item described as the factory surplus. It is to the works manager that the managing director will look to produce a factory surplus of a sufficient size to pay for the company overheads and other charges and leave an adequate profit at the finish. For this reason, therefore, the works manager should be definitely interested in having the regular monthly control figures placed before him.

There is a further point arising from these monthly figures. The factory on-cost under the higher control method is made up of four categories, known as indirect material, indirect labour, general charges and standing charges. If the expenses arising in the factory month by month are collected under these headings and returned to the works manager regularly month by month, he can, by entering them on a twelve-column sheet, side by side, compare each month with the previous ones, and see whether his expenses are rising, and if so, in which particular section. When twelve months have elapsed he will have the additional advantage of being able to make a moving annual total of those expense categories and from that time onwards, at the end of every month, he will be able to compare the moving annual total of any item of expense with the same figure as studied at the end of the last financial year.

You will appreciate that this is a very valuable comparison indeed. The moving annual total cuts out all seasonal influences, and by so doing enables the reader to see at a glance whether the twelve-monthly expenditure is higher or lower at the end of any month than it was at the end of the last audited period. Naturally allowances must be made if turnover is expanding or contracting, but at any rate the works manager who has his figures returned to him on this basis each month will undoubtedly have a very valuable yard-stick by which to measure his own performance.

With regard to the question of costing, you would scarcely expect me to recommend any course except that of providing adequate and accurate costs, in order that the works manager may see clearly which lines are profitable and which are not. At the same time I have often wondered whether there could not be found a middle course with regard to costing systems—one coming midway between the practice of having no costing system at all, and

the practice of having fully recorded costs with every establishment expense allocated.

I sometimes wonder, when I see inefficient and practically worthless costing systems dragging their weary way along in medium and small concerns, whether it would not be wiser for the firm which maintains that it cannot afford the wages of an efficient costing department to abandon the existing system frankly, and rely upon the higher control figures, with special cost estimates being made up as and when required. Alternatively, much, in my opinion, can be done by restricting the costing department to prime costs only even to achieve the accurate—and would you be good enough to note that I specifically say, the *accurate*—booking of time and material on a given job, is by no means an easy task for any business, whether big or small. Presumably the sale price has been fixed on an estimated figure for direct material and direct labour used against that in the estimate. On-costs are not to be controlled through the costs—they can only be controlled through the regular survey of the total sums involved in each section, before distribution. If, therefore, direct material, and labour are inside the original estimate, and all factory on-cost items are being carefully watched against a pre-determined budget figure for the year, surely the works manager can achieve a pretty correct idea of his costs, at a minimum of staff expense.

In addition to control and cost figures, the works manager will certainly have a small collection of special statistics in which he is personally interested. To go into the various possibilities of these to-night would make this paper, which is already too lengthy, altogether too unwieldy. May we, therefore, take as a recommendation that the works manager must see that he is supplied with an adequate range of facts and figures from which he can see clearly whether the place is going on satisfactorily or not under his management?

Finally, gentlemen, may I say that I recognize the regrettably superficial nature of the survey that I have put before you. To attempt to outline in the course of an hour the duties and responsibilities of the works manager of a small concern was perhaps to tackle too ambitious a task. One thing has impressed itself upon my mind whilst I have been dictating these words, and that is that whilst it behoves all those in authority to be careful and judicious in the choice of their assistants, undoubtedly in the case of a works manager of a small factory that fact takes on an even greater importance. There are so few front-line individuals in a small place that it is the highest degree necessary that those who are in charge of sectional duties should be well able to carry them out effectively and with commonsense. As you know, the difference between a £3 a week man and a £5 a week man is, or should be, a wide one, yet

in the total expense for the year it only means £104 of additional cost to the place as a whole. To economize by having low-rated men in any of the key positions of which we have spoken to-night is, in my opinion, folly of the worst kind, and if nothing else comes out of this paper I trust that this one fact will stay in your minds.

As I see it, to be a successful manager in a small factory requires the gift of leadership, the power to weld a group of individuals into a team playing together, and, perhaps the most important of all, the capacity to avoid being overwhelmed by the continuous rush of routine work to be done. It is not difficult to sectionalise the work and to set out the minimum duties that must be effectively performed if the management is to be sound. After that the whole thing largely resolves itself into the capacity of the works manager to get his small staff to carry out those duties correctly.

This may seem to you a vague conclusion, but the efficiency of the small factory can only be built on the efficiency of the man in charge. Like the captain of any ship, large or small, he is responsible for the security of those under his command, as well as for the vessel itself. If he wastes time in attending to minor details—and it is for him to say whether the detail is a minor one or not—there may be trouble before he knows what is happening.

Perhaps the gist of the whole matter lies in the simple fact that the works manager of a small factory must hold on to his ideals, and not allow the remorseless pressure of daily difficulties to drive him into taking the line of least resistance. If he can avoid that, if he can set his standards and keep to them, he will create a spirit around him which will build up and maintain the working efficiency of the factory and of all employed in it.

### Discussion, Edinburgh Section.

MR. PEET (Section President) : I think Mr. Medd has done justice to Mr. Rose's paper on "Works Management." In connection with the buyer, Mr. Medd, you did not say anything about following up for deliveries. Deliveries often get behind and if no one but the buyer is taking it in hand it is often just allowed to drag on. What would you say in regard to inspection—I am taking it of course that we are talking of this 200 employees factory—what would be the cost of inspection per £1 of labour? You also gave one little point in connection with the process man sending up reports of what the savings had been to the directors. My experience of that sort of thing is that the directors usually say they cannot see it in the balance sheet, and as, naturally, the production man's end is not the balance sheet end he really cannot do anything.

I suppose in a concern of that size all the chasing up outside would be done by the buyer, because he would probably be the only person who was capable of dealing with the correspondence, but I should imagine that the progress man would be responsible for keeping the buyer up to scratch. The buyer should keep a record book of which deliveries are due and follow them up automatically, but I think it would be up to the progress man to chase the buyer and see that he wrote necessary letters about orders requiring special attention.

I think Mr. Rose in the paper protects himself about the cost of inspection. Obviously the cost will vary enormously with the type of product and the accuracy required. I thought that the number of inspectors he specified was fairly high; for that number of employees he talked of two men and some girls, or alternatively six men, and that would presumably give you a percentage of inspection labour to total labour of say 3%, perhaps a little more, but I haven't really a figure in mind, and some one here may be able to add something on that.

The question of reports on savings in the works. I did think in reading the paper that probably if that point were put to Mr. Rose he would have said that these reports should come through the works manager. I can hardly imagine that the process man would report otherwise than through his immediate superior. The directors would look for a saving in the accounts, but of course it would be difficult for them to identify that particular item. I think the value of that is that it keeps the man up to scratch, and that is the first consideration in a small works, or in any works, namely to encourage co-operation of everyone and to make everyone feel that he is a part of the concern and that what he is doing is being appreciated by those above him.

MR. WILSON : What would you say was the direct responsibility of the works manager, the works director, and the managing director? Where does the one stop and start actually; are the works manager's duties and the works director's not concurrent, running with each other?

MR. MEDD : Yes, I think that in this small concern, the works manager really is the works director, and perhaps in the remark I made about the reports of the process man was wrong. I think that the intention here is that the works director should also act as the works manager. In a concern of this size I think that is quite practicable. I expect most of you gentlemen are concerned with much bigger works, but it would be interesting to know whether anyone here is concerned in managing small works such as we have been discussing, and if so, what type of monthly records you find it convenient and practicable to keep?

MR. PEET : There is one thing in connection with that. I would suggest that a works manager in a small firm should really go in for monthly meetings of his staff and keep in close contact with them, especially the foreman, the process men, not particularly the planners, but they could come in really for information, and I think that if they tackled it on a monthly basis, such as a monthly conference, and also at the same time, they would have to run to schedule in connection with their estimates against their actual costs, what I should call a trades accountancy scheme, and for every job that went out into the shop the estimate would already be known and the foreman would have to keep up to that estimate. That could be done by keeping in a small loose-leaf ledger in the office the figures of the weekly cost and a clerk from the office could come down to the particular foreman say for half an hour once a week and go through what he had actually spent, so that by the time the job was finished it would be seen—it would be seen before then—actually how much that particular job was over, or, very seldom, how much it was under. I think that would be the spirit to get accurate costs from the shop.

MR. MEDD : Yes, some form of works meeting is admirable, but in my experience they need careful preparation and to have definite agenda in front of them. I have had some experience of works meetings and I know you can spend whole afternoons at them and wish you hadn't been there. I was watching one at another works the other day that was done quite well. I think that these monthly returns would be the basis of such a meeting, but it wants a strong chairman to keep the discussion on the point. I think you also need, if you are going to have a meeting like that, to give it a certain amount of power, to take some notice of what the people say. It isn't much use taking people into the meeting just to talk

and if they come away without feeling that what they say has any effect on the management.

MR. WILSON : Mr. Medd, have you in your experience actually tried out that scheme of what I would call bothering the foreman with actual costs, to tell him how much money he is spending in the week ? Should he not be left to make quality in his work and look after his men, and have nothing to do with the cost at all ?

MR. MEDD : There again I think it depends very much on the nature of the product. I submit that all engineering production is firstly production of something which will do its job properly, that is to say, looking after quality. Secondly, it must be made at the right cost : any fool can make a job right if he spends enough money on it, and the real problem is to do it economically. Therefore, the foreman must be interested in costs, and I think that if you can let him see what is happening, what he ought to be working to, and let him see quickly what he is doing, instead of giving him figures for his March costs in the following December when he has forgotten all about them, you will be making his life more interesting and will liven up the whole place. But it entirely depends on the nature of the product and on how long a particular job takes to make as to how quickly it is possible for a cost department to give the foreman those figures, but I feel in most cases some means can be devised to let him see what is happening, and I think it is most important that he should realize that it is his job.

MR. CORBETT : I was rather interested during the paper to hear Mr. Medd say that when the works were getting a bit slack he suggested making parts for stock. Does he when he is doing that credit the works in their monthly accounts with the value of the material he has made for stock, or doesn't he give the works the credit for that until the goods are actually sold ?

MR. MEDD : Looking at it from the works point of view obviously you must give the works credit for material made for stock, because strictly speaking it doesn't matter to the works whether they are making for stock or not. The works have just got to regard it as any other order. But no doubt when making your monthly returns you will show separately what is going into stock and what is going against outside orders. It will all depend again on the nature of the product. It simply requires the decision of the Board as to what the size of the stock should be. In works I have mainly been concerned in most things are made to special orders, but a certain amount of work can be made for stock when the opportunity arises, but the works would then regard that as an ordinary job, from the works point of view.

MR. PEET : There are other firms who do nothing but make for stock and then draw their orders from stock—the works must definitely get credit for that. There is a point in connection with the



facilities for small factories. Just outside Glasgow, I believe—take that as an instance—it looks as though we are going to have quite a number of small factories that will probably be employing anything round about 50 to 100 people. Therefore, it is obvious that the small factory is coming to the fore. The large factory is all very well, but it will never oust the small one entirely.

MR. MEDD: I was recently in touch with the Chairman of the North East Coast Trading Estates Scheme, and he said that all the firms starting there were quite small ones.

I may mention one handicap on the small firm. I was Chairman of quite a small company making engines, only about 40 employees, and I experienced the difficulty of getting capital for a small company like that. I do not know whether conditions are always going to remain the same. As you probably all know if you blow a big trumpet and ask for a million or two to make a big factory you can quite easily get the money, and as easily lose it, but if you make a modest proposal no one would think of giving you any money for it. That is a handicap on the small firm, which makes it so difficult to see how there are so many of them and why they do manage to exist.

MR. LEE: In connection with this question of large factories and small factories, I wonder if the secret is that in the case of the small factory the owners of it manage it, whereas in the case of the extremely large factory the owners are usually possibly a large body of shareholders, including probably highly respectable maiden ladies, and so on, and the management, of course, is left to salaried officials. I am not casting any aspersion for one moment on the salaried officials, but from my own experience, when a man himself owns a small place he is keen to see how it is run, and I know men who put in Saturday afternoons and Sundays in running their own places, and I wonder if that has something to do with the efficiency of the small factory.

MR. MEDD: It is obvious that that has a very big influence and it is practicable in certain cases, and such an owner-manager is probably doing the work of three or four men. On the other hand the small man has the disadvantage that he cannot get such a highly qualified technical staff. If the works can run without that, well and good, but otherwise that may to some extent be a cause of inefficiency. I am not sure that your criticism of the large firm with its maiden lady shareholders is just. Surely it is a question of the organization of the big factory, and there is no inherent reason why, if you have proper organization, you should suffer from inefficiency. It entirely depends on the staff and the plant that is wanted for a particular product to get the ideal conditions.



## Discussion, Glasgow Section.

**MR. WRIGHT :** The duties of the chief inspector, Mr. Medd mentioned, were essential in a small works and he should at least see the finished product before it goes to the customer. I don't know whether he means merely that, but I should say that it would be more economic to make the duties of the chief inspector in a small works more elastic than that and I think that the economies that would be made by the inspector looking at the job in the early stages would be well worth consideration. I should like to know whether he really thinks that the finish of the process is really the time for an inspector to look at the job.

**MR. MEDD :** I do not think Mr. Rose intended to suggest that the inspector shouldn't see the parts until the finished final stage and I certainly should not myself. I think that if you were dealing with a particular product, then you could answer the question, as a great deal depends on the nature of the job, but I should imagine that hardly any product now would be satisfactorily made unless the inspector took some interest in it before the final stages and I find myself in agreement with Mr. Wright there.

**MR. W. P. KIRKWOOD :** In the beginning Mr. Medd emphasises the necessity for providing the shop with final arrangement drawings and he suggests that in a small factory such drawings were not often available. I would put it rather differently. I think drawings adequate for the shop are available, because most draughtsmen have to make some kind of scheme or rough arrangement showing how the various parts are put together in order that they can make the detail and a print of that is usually all that a practical foreman needs to enable him to put his parts together and get the satisfactory final arrangement. Too often, however, we find these are secreted away in a corner of the drawing office and they are only brought to light after considerable search and I think that could be improved upon.

Then in connection with the buyer, it was suggested in the paper that price came third, quality and delivery coming first. I think you will all appreciate the importance of both quality and delivery, but I do not think it is right to put price third. We have got to remember that in most engineering products, the total cost being taken as 100%, the material may rise to as much as 60-70% and the rest—30%—comprises direct labour and on-cost. Now that is a very big figure and a saving there can more than counter-balance any saving that can be made on the wages if it is done with discretion and I would like also to emphasise that for smaller specifications and smaller deliveries you can get a very wide

range of prices, depending on the firm who are quoting and the conditions in that firm at the time. It is not unusual to find 50% or 100% different in price. I am not just saying that blindly, because anybody who has experience in getting any quotations will bear me out and the essence of good buying is to combine the price with the possibilities of bad quality or bad delivery and to make the best bargain for the firm all things considered.

In connection with the monthly programme, I would like to know how delivery promises are dealt with, under what system, as in most cases promise of delivery will have to be given two, three or four months ahead and a monthly programme would require some other addition in order to make these promises with some hope of maintaining them.

MR. MEDD : Mr. Kirkwood referred to the question of arrangement drawings. I have often known cases where they haven't been ready in time. The draughtsman no doubt has to have some kind of general arrangement in front of him before he starts his work but that is usually not a drawing which he can put into the shop. He may start with a general arrangement drawing of a similar thing, and he may use that as a guide but when he has finished the job that arrangement drawing in most cases will not be suitable for sending to the shop and he cannot therefore make his final arrangement drawing until he has finished his detail and I have known of cases where the general arrangement drawing does not get into the shop when it should ; in the case of some productions there may be instances where the alterations to the stock drawings are so small that they are made on existing detail drawings and the standard general arrangement drawings can be sent to the shops as they are.

He asked about the buyers' duties—it is of course really all a question of proportion. We may accept as more or less representative the 30% material, 30% wages and 40% overheads and profit, but undoubtedly there are buyers who do what is described in the paper and do not save their firm money in the end. I have experienced within recent years, or at least since the last boom began, prices varying to the extent Mr. Kirkwood mentioned, but in more normal times that does not often happen because the buyer will only be going to the firms from whom he expects to get fairly competitive prices. Again, it depends on how closely he is able to specify, how sure he can be that if a thing is made to a certain specification he will get what he wants : that is not so easy to do in steel castings and it depends on the nature of what you are buying as to what judgment you can use as to accepting the lowest price.

The monthly programme—that is a question which again depends upon the nature of the product. Mr. Rose in his paper has in mind, as he says, making things in batches of 10 or 12 up to 50 and in such cases they are obviously made for stock and the question of giving delivery against particular orders does not so much arise. There will probably be so many of a batch wanted for a certain month and there will be no need to consider a particular customer until the time comes for despatch. I agree that special orders must be planned in the programme against the date they are due. But it is impossible to cover everything in every different instance that may arise in one paper.

MR. S. M. HARDAKER : Mr. Kirkwood has dealt with the first two questions I was going to mention, namely the drawings sent out to the shop and the buyer. I will deal with the drawings first. Speaking with over thirty years experience I have never dreamt of sending tracings into the shop. I certainly have seen prints and outlined copy drawings. Again, I would never dream of sending tracings into the shop. I entirely disagree with Mr. Rose on that point. Dealing with the question of the buyer, no mention was made of his training. From my point of view, having a good many years experience, I should say that a good buyer should have an engineering training to begin with. Another point is the question of reciprocity that has not been touched upon. Conditions today are so difficult depending on the policies of the firm for whom you are employed. You may have to buy on reciprocal lines quite apart from the question of price, and I would like to hear what Mr. Medd has to say about reciprocity. I do not know whether I am dull or not but I don't follow his remarks on costing. He frequently mentioned the works manager. I was more inclined to think he meant the general manager.

MR. MEDD : I agree with Mr. Hardaker that there are now few who would send tracings into the shop, but it used to be done. One sometimes comes across a firm which hasn't made a particular machine for a good many years, and on looking up its records it finds that the only thing it has is a torn tracing of it. I don't suppose that any firm would now attempt to use that, but would make drawings of the different items and get them properly scheduled.

I thoroughly agree with him that a buyer should have an engineering training, and I should think that is common now, but he must remember that we are dealing with a small firm in this paper of only 200 employees, and it is quite possible that the buyer may have been trained in the office as a clerk. I do not agree about reciprocity. I know that one has come across that increasingly in recent years, and I do think it is a very great mistake to trade in that manner. I do not think a firm ought to expect, however friendly, that you

should buy their goods if they buy from you. Every buyer ought to be able to go to a place where he can get the most suitable article, otherwise it is putting a handicap on both people. There is no reason why all firms should not work on a friendly basis, and I am quite sure it would save a lot of bother. I think such reciprocity is a mistake.

In the small firm we are considering the general manager, the works manager and the works director may be the same person. I am sorry, however, that I do not quite see what Mr. Hardaker meant.

MR. HARDAKER : My point was dealing with specific information for the works manager which I thought was meant for the general manager.

MR. MEDD : Yes, I think the paper does refer to that, but up to a point these returns of the factory costs are for the works manager. The system of higher control does go beyond that, but surely it is essential for the works manager to get his works costs returned to him regularly and for him to see whether he is coming within his figures or whether he is not, and that I think is the point that is really made there.

MR. G. BUCHANAN : I think Mr. Medd, or should I say Mr. Rose, should be congratulated on the very excellent paper he has put before us to-night. When one considers the tendency nowadays to describe large factories which make shredded wheat or chewing gum or things such as these which are made in mass production, a paper such as this is very welcome. Indeed, I do not know of many here who are working in factories which have only up to 200 employees. These must be very few indeed and probably you won't get a criticism of such a factory, or rather we have been trained in such large factories that we do not understand just exactly the point to put forward. I have had experience of small factories, say, with numbers of people up to 150. The matter which Mr. Rose has put forward cannot be disputed. There is one thing I would like Mr. Medd's opinion on. Some people issue drawings to the shops on which there are lists of materials. Others' lists of materials for components are separate. I would like to have his opinion which of these two systems he thinks better. Then there is the other point of one drawing and one component. Even in a small factory I think that one drawing and one component would be very useful. I should like to hear your opinion about that. Then again Mr. Rose has not touched at all upon the training of apprentices. There must be adequate means of training young people to come forward in a factory of 200 employees, and I would like to hear just how he would propose to train these apprentices in such a small shop.

Then about the monthly conference. I would be rather afraid that we would get into difficulties in the third week unless to the

monthly conference a weekly one was added. In fact, I would suggest a weekly conference, and therefore, I would like to have Mr. Medd's opinion about holding a conference with the people interested in personal contacts. That means, that, say, every Tuesday morning these people should meet together and discuss the various things which have arisen about the work.

On what Mr. Hardaker said I do not think that a buyer should have a training in engineering. A little knowledge is a dangerous thing, and I find that a buyer who has been trained in buying without having seen an engineering shop makes the best buyer. He is free to negotiate without prejudice. About the works costs, I think it is an admirable thing—Mr. Medd called it higher control—to put these before the works manager say once a month. By seeing these various overheads he is able to control them.

MR. MEDD: Mr. Buchanan has given me a lot to deal with. The figures quoted in the report for the numbers in large and small factories are very remarkable. It would be very interesting to hear comments of some of those present as to whether they think these small factories should exist, but as far as one can tell from the figures in this report and previous ones they do not seem to be tending to die out.

On the question of lists of materials and separate drawings, the paper refers to productions made in batches and therefore fairly standard articles, and it is more practicable in such cases to have separate drawings of different items and, when that is carried to its logical conclusion, it is obvious that you can hardly make a list of one item but it will certainly show how many are required for a particular order which is being put in hand, but in such cases it is best to have a standard list of items on a standard schedule for that particular production, engine or whatever it is. With a list of the drawings and list of items the people in the shops know exactly what they have to make, and they don't finish the engine without say, the crank shaft.

The training of apprentices is a subject which is not dealt with in the paper but is of the utmost importance. The choosing of apprentices is sometimes difficult. If a firm has a good reputation it can usually get good apprentices. Of course, there was a time for some years after the war when everybody wanted to be an engineer and then a bit later nobody did, but it is a difficult matter in a small place to get a flow of apprentices appropriate to the size of the place, and if you want to have one new apprentice a month or one a week, or whatever it is, it is not always easy to do that, but it is important that apprentices should be taken on not in big batches, but at regular intervals, and that each should get individual attention. It is certainly necessary in a works however small that someone should take a personal interest in them. I think that the works director

should make a point of seeing all apprentices before they start and that he should take an interest in them and should personally see each boy once every six months. He should get reports from the foremen as to how they are getting on, and see that they are properly moved from one department to another, and that they have a proper chance of attending technical classes.

Dealing with the question of the monthly conference and whether it might have to be weekly instead, and that there might be a discussion, I think a weekly meeting might be advisable, but whether it is really necessary in a works so small as this is a question. It is obvious in a place of 200 employees all these people will see each other half a dozen times a day for purposes of ordinary discussion and the carrying on of the works. I do think that a regular works meeting, if it has a properly prepared agenda under a good chairman, is advisable, but if you do that you must give that committee a certain amount of authority or, at least, you must let these members feel that what they say at that meeting has some influence on the procedure of the firm. Otherwise you simply get a discussion meeting and you are no further forward. If properly managed by the chairman you can get useful suggestions, and it is advisable to deal with those suggestions at the time, act upon them and try to get them carried out, so that each person sees that he is doing some good, but it is not an easy thing to do.

I am interested to see that Mr. Buchanan does not altogether agree with the buyer being an engineer, but I should hesitate to say that it is a bad thing for him not to be an engineer; also that he approved of the works costs, going to the works manager, but I do not think I need comment on that.

MR. W. BUCHANAN: There is one point that has struck me forcibly and that is how many are left out of the 200 to do the work? We have been hearing about chief inspectors, head storeman, planners, and I am quite sure that in any works of 200 employees you generally find that the owner does all these jobs. Referring also to the question of apprentices in most works of that type you generally find that they are generally all apprentices, or one journeyman, and the rest apprentices. But there is one point I would like to know more about, namely, how are the figures collected for the making up of this costing, and how are the jobs planned and put out to machines with time allowances, or is that just left to the foreman?

MR. MEDD: I haven't reckoned how many are left out of these 200 people, but I don't think the paper refers individually to more than perhaps about ten different people, apart from the inspectors. I think, if we count up all that we referred to, there would be about

thirty and that would still leave 170. I don't think it sounds quite so bad as Mr. Buchanan implied. I know that in some places the owner does all these things, but he probably does not do them as well as they would be done if he got someone else to do them, and it again depends very much on production whether he wants six inspectors or one. I think we have enough to do the work.

Now regarding apprentices, that varies very much in different works. I do know that you will come across works where there are perhaps 25 or 50 employees and perhaps only two or three journeymen and leading hands, but this is usually in a fairly low class of work. In a fairly old established business making a standard thing of not very high degree of workmanship, where that is possible, the apprentices do not get such a wide training, but they do get a general training which in some places is almost as good as they get in a very big place, unless in that big place they are very carefully looked after, but the apprentices I imagine would not amount to more than 50, probably, less than that, perhaps 25 in an ordinary engineering works.

How are the figures collected and how are the jobs put out to machines and the fixing of rates? I presuppose that this factory may be working on piece-work and we have not discussed the question of time setting, and if that is done I think it would be necessary to have in a place like that a proper rate fixer, but the putting out of the work can quite well be done by the foreman. I don't think they would have any difficulty in the allocation of the work and putting it out, but I do think they want a rate fixer.

MR. HARGROVE (member): First of all I must apologize for not being present more often, and I congratulate the Institution on the wonderful success they are making in Glasgow.

In turning to the paper, I think we are all indebted to Mr. Rose and we are equally indebted to Mr. Medd for the very able way in which he is answering the questions. Now I do not wish to quarrel with anybody, but I presume that we are taking the definition of a small factory more or less as indicated by Mr. Rose and, judging from the figures as far as I am able, I think we have gone a long way off a small factory when we are talking about 200. It seems to me that we ought to be talking about the one to 25 group. Would you really say that 250 people in a factory was a small factory, or on the average is it a medium factory? In any case I would like Mr. Medd to indicate what are the real problems, first of all, in the small factory in comparison with the big factory or the medium factory.

It gave me the impression from the discussion that two most important things about this factory are the drawings and buyer. My suggestion is that most people in the small works have a much bigger problem in the batches. Impressions are sometimes misleading. I remember in one place I was told that the batches were



on the average 100 and when we measured the average batch we found it was from three to four, and that is the difficulty that a small shop has to tackle. It is suggested to-night that every factory is a mass-producing factory making one article. I know a number of people who have small shops of 20 to 25 workers and that is one of their great difficulties.

A friend of mine has done a curious thing and he seems to be making money. When times were bad he bought machine tools. He gave every man two machines, and there are one or two setters-up and these keep them going, machining one job and setting up the next one ready for the operator to go ahead. He has got over his difficulty by putting in the tools and seems to be making profits.

Another suggestion which we may all be familiar with is when a large number of copies are required, this is done by putting a piece of carbon paper reversed on the back of a typed sheet, the typist types it and half a dozen blueprints may be taken off it.

The stores in my opinion are certainly an important section, and in that connection I suggest that in a small factory a good man looking after the incoming material is saving money. Not many years ago I tried to buy bolts and nuts to the standard B.E.S.A. fits. I found that nobody could supply me with bolts and nuts, and certainly not from the other side of the border, and when I complained that the nut would not go on to the bolts, I was told that this is not uncommon, and if you had a good man in the stores he would see that your nuts would go on the bolts without putting a spanner on them and wrenching the thing to bits, and I suggest that a small factory should have a man with a knowledge of engineering looking after the choosing of the material, seeing that the material came in and doing a bit of planning.

We are talking about really small places where, as our friend says, the general manager is the managing director and may have to be the planner and time-keeper and that sort of thing. Now there are certainly very great difficulties in planning a small factory with the long view to their becoming big places and many have started with small factories. I remember Sir Henry Fowler used this phrase—"If your works consist of a tin shed in a back court, plan it, for one day you will wake up and find that you have got the ideal works that you planned." I think planning is very important in everything we do. Another man said—and I think this is quite important—that "every man in a works has a financial implication," and if this is drilled into every individual in the works I think it would overcome your problems.

There was one remark made by Mr. Rose in his paper. He said that people in any works where you have changes get personally interested in the place. I was in a managing director's office one day and the works manager knocked at the door. He said: "Mr.



Brown, will you speak to one of the girls, she is leaving." Mr. Brown said: "certainly, what is she leaving for?" "She is getting married." When the girl came in he said: "I am very sorry indeed you are going to leave us. How many years have you been with us?" "Mr. Brown, I have been with this firm eight years and, if it wasn't I was getting married, I would not go, as I don't like leaving the machine." "What machine are you on?" She said: "the press—I have been on it all my eight years." "That is nonsense, I have always insisted on the girls moving from one machine to another." The works manager said: "This girl was so fond of that machine that we never could move her."

REPLY: Seeing that this is a Meeting of Production Engineers I think you would probably grant that 200 is a fairly small factory, and I do not think at this time of the evening we can really start to discuss organization of the 25 employee factory. Interesting as it would be, I really feel that I had better not try that. Mr. Hargrove dealt with a number of points we have been discussing. What he said about the two machine tools, materials and stores is very interesting. I was also interested in his suggestion that every man should be regarded as having a financial implication. I might give a little instance of that. Some years ago when trunk calls were becoming more common—you probably all experienced it—and the telephone bill was going up and up and up, I thought it would not be a bad thing if I gave instructions to the telephone operator to say when putting through each trunk call: "Here's your call to Glasgow—3s. 6d. for three minutes." It was quite effective, though it was not carried on for very long, but it just conveyed the financial implication, and I think it was quite a good practice in a small way.

MR. NICHOLSON (visitor): Regarding the small and large factory, I don't wish to bring in a discussion on the 25 employee factory, but I do want to refer to this chart which we had given to us when we came in, and it is of course suprising to most of us to find that there are only 3% of the factories in the country making returns of employees who have over 1,000 employees, but on looking at the figures I am inclined to think that they are a trifle misleading. I would hardly call a place employing only 25 persons a factory and I therefore suggest that since Mr. Rose's own definition of a small factory is 200 we might reasonably cut out the first one or two and start our factory at 50. Up to that they are family concerns almost, and if we do that we find that factories of over 1,000 would then come to 2½% or thereabouts and the other figures of course proportionate, so the thing looks more reasonable than it does in this particular chart. My main interest in the paper is in the costing and I am extremely surprised to hear a man of Mr. Rose's experience say that he has not yet come across a system of costing which is

not betwixt or between. I am sure that in his experience Mr. Rose must have come across what are known as "standard costs" and I am sure you will agree the application of standard costs does not call for the detailed analysis work that is required by what we understand as production costing. Merely by comparison with standards which have been previously set, we have obtained our cost control and I think it is a remarkably efficient method of cost control without being at the same time expensive. I believe that I speak with some little authority with the experience of having installed more than one system of standard costing in different types of factories. Again this method of standard costing calls attention to the fact that Mr. Rose is using as a means of comparison figures for one month with a year, or alternatively one month with a previous month and that is to my mind a system to be severely condemned. You cannot say that one month's figures, be they sales, expenses, or anything you like, are a measuring rate for the next month. You must have a more definite and a more accurate measuring rate than comparing one rate with the next because if you are a long way up at the start then you are always going to think that you are on the right side merely because you are comparing one month with the other and there again I am sure that standard cost will get you over that difficulty.

Another point in connection with the costing side of the paper is the remark made that sales figures are fixed by a system of materials and labour. There again I do not think I quite agree because in the factory which we have outlined tonight of 200 people we are told they were working in batches probably working on a mass production basis, and the prices for mass production material are surely fixed by market and not by cost figures. There are not many people today who are in a position to sell goods that are based on actual cost. You can sell on market price and you must bring your cost to your market price. You cannot take your market price up to your cost.

REPLY : This is a very interesting contribution to the discussion and there are one or two comments I might make about it. You say you are not going to call these 25 people a factory but if you take off the first two, you are taking up 22.7% of the total people employed in those factories. It is a pretty big bit to take away. I don't think you can just do that. What you have got to remember is that they are operating and they will continue to operate and they presumably are serving their purpose and if we had time we might consider how they should be run.

If we had time it would be interesting to go further into the question of costing. I agree with Mr. Nicholson that a great deal could be done with the method of standard costs that he mentions. He said that one month was not a proper comparison but it would

depend entirely on the work being done whether it is a fair comparison, but in the system of higher control which Mr. Rose has worked out you are really comparing a year with a year all the time and that gives a very much better idea of what is happening.

I agree that most factories have to sell against the market price, but I think the paper really protects itself against that criticism by only introducing that method for considering what has to be done in the month in cases where the output is so variable or what is going to be due in that month is so uncertain that you cannot fix it in any other way. I think Mr. Rose's point was that you must fix something somehow for the works to work against in that month. You must give them some figure even if it is not an absolutely rigid or proper figure. I do not think at this stage I should try to elaborate that point further but I do agree that it is very seldom that a firm can fix its selling prices merely by consideration of its costs.

MR. J. MCFARLANE (member); I wish to record my personal appreciation of the general excellence of Mr. Rose's paper, even in the face of the various criticisms we have had, also my appreciation of the difficult rôle Mr. Medd has been called upon to play. He has succeeded on the spur of the moment in replying satisfactorily to most of the questions and criticisms, but I think it only fair under the circumstances to assure him that he will be given an opportunity to revise his remarks and amplify them in collaboration with Mr. Rose, so far as he may deem that necessary.

MR. MALLETT (member); It has been my privilege to work in both big and small factories and Mr. McFarlane partly stole the words out of my mouth. I did not see much wrong with the paper. It struck me that, if that paper had influenced the people I have worked with in the past and they had acted on it, quite a lot of good would have resulted. I think in the beginning of the paper it was amply clear that some of the points were purely illustrative of what they meant. For instance, the meeting the third week in the month was only chosen as a sample of what they had in mind. He started off by saying that these were the things to look for in a new factory, just as he has had to look for them in a number of factories he had already visited. He was simply giving us a sample factory. He is just taking this sample factory that Mr. Rose has created and taking the figure of 250 for the workers. There are actually 2,307 between 250 and 500 and 6,460 between 101 and 250—quite a decent number of factories considering there are only 335 of 1,000 workers and upwards. I think the 250 figure was quite good.

My own experience of the small factory has been that not only would you need to apply the "system" part of Mr. Rose's paper, but one of the most important points was brought out at the end

where he put forward the point of personality, that in most successful small businesses there is a feeling of a happy family. That family feeling is generally brought about by personality rather than system, and sometimes it is based on payment too, and in that respect if Mr. Medd can answer it would be most interesting to know what Mr. Rose has found as the most suitable system of payment for factories of this size, whether to employ the right type of labour which can work on time or whether to pay on piece-work, or whether to pay a bonus on output. One friend I had who started his own small factory actually paid the workers a bonus on output, and he paid each staff man a bonus for his respective duties. He had a costing system, but it was such that it gave him an idea of how each man was successful in his own job. It sounds complicated but I can assure you it worked out all right.

The other two points are small ones. One is, I do not like any idea of a schedule on drawings, because it is so difficult to distribute throughout the shop. I think Mr. Hargrove brought out this point about the number of copies. A typewriter or one of the present duplicating machines can be used and, in that respect also, mention was made of the use of carbon paper. In addition to schedules, sketches made on loose sheets, with carbon paper behind and facing the sheets, can be used for giving excellent and clear blueprints.

There are factories which definitely need this measure taken, because I know one running at this present moment in Dundee where they have no draughtsmen unless they are very busy, but the draughtsman does a little bit of rate fixing, a little bit of progress and, when they want a spare part made, the man is sent up to the loft to get the sample down and they produce the spare part from the sample.

REPLY: I thank Mr. Mallett very much for his remarks. Of course, it is true that when one is dealing with a specific factory it is pretty obvious what ought to be done, but it is a matter of actual everyday experience to me and probably to all of you to find that these obvious things are not always done. Although they may be obvious it is not a bad thing to put them down and really to think about them, because there are really a lot of places where they don't do them. I agree with him about personality, but it is no use altogether relying on that. Your personality might get a cold or something worse, and it is not a bad thing having some system.

On the question of payment, I had no chance to discuss this with Mr. Rose, so I really do not know what his views would be on some of these points but, from the fact that he does not refer to systems of payment, I should think he had in mind that it may be on a time basis. I do very much agree that some system of reward should be drawn up and made applicable so that people really have that interest as well as a personal interest in the actual business,

## WORKS MANAGEMENT IN A SMALL FACTORY

but my experience in small places is that, if you can get a man who is any good, he is really not thinking all the time of his wages and that he will do a good job if you let him. There are workmen in this country who want to do a good job, and if such get the chance, and if you encourage them in doing that, you really need not do much more beyond, of course, paying them a fair wage.

As regards the remarks about the schedule on a drawing this is, of course, very true and, even when they are on the drawing, it is a good plan to print that part separately and distribute it to those interested.

## Discussion, Yorkshire Section.

MR. A. SYKES, M.I.P.E. : Mr. Rose has addressed us to-night particularly on the small works, but he is also experienced in large works. When I first met him—about seventeen years ago—he was Works Manager for Leyland Motors, Ltd., which was at that time employing between 2,000 and 3,000 people, so that his knowledge extends both to large and small works.

He has outlined a number of general principles for us, which I think we shall all be able to see apply in some measure to our respective businesses, although not perhaps directly. In some cases two or more functions may have to be combined in one man ; in others one of the functions may have to be split up between two or three people ; they will have to be adjusted according to the requirements of the particular firm. He has refrained from concentrating on any particular type of works, but has endeavoured to give us something which will be useful to us all. I was very much struck by the analysis he gave us in the figures taken from the Board of Trade returns as to the size of factories and the large number of small factories. I had no idea there were so many small factories and that the large ones are a relatively minor proportion of the whole. I wonder whether this is peculiar to this country, or does it apply to other countries also ?

It rather struck me that the very fact that the medium or small factory occupies such an important position shows that it has found its place and that it is essential in our national life, and it may be for the reason that in a medium or small works there is that close personal contact between the employer and everyone concerned which is so valuable, which has caused the small works to hold its place. In a large works it is difficult for the head to know everyone, whereas in a medium sized works he usually does know everyone and knows their peculiar characteristics, and they work together as a family.

Mr. Rose spoke of the position of the buyer. There was an idea at one time that a good buyer was the one who could squeeze the most out of people from whom he was buying, but I think that idea is going by the board, and it is seen now that a buyer is not one who can do the most squeezing, but is one who can look upon his suppliers as perhaps a department of his own works—somebody that has to give service—and the good buyer is the man who can get the best all round service from the people from whom he is buying.

He also referred to the position of inspector. That is by no means an easy one. An inspector has to be capable of exercising a great deal of discretion. Any man with very little experience can

reject work, but a good inspector is one who can draw the line, which is always difficult, because there is nothing in this world which is perfect. It is a matter of deciding just what is good enough and what is not, which requires an extremely practical man.

I would like Mr. Rose to enlarge a little more on the question of progressing. Has he found it practicable to plan beforehand so as to do away with the chaser, or is the chaser still essential? A good chaser has to speak his mind and has also to be tactful; perhaps he can serve a useful purpose even when there is good planning.

CAPT. L. J. SARGEANT: I have always been the servant of a big company, and possibly with the idea that the other side of the road seems less crowded than the one you are walking on, I feel that if I could arrange things as I liked I would like to be connected with a firm of a strength of 100 to 400 people, where the personal touch must and can carry through the organization. This point appeals to me very much because I know so well the difficulties which obtain in a large organization.

You raise a point, Mr. Rose, about the question of Works Committees as being a very debatable question. Well, my view is, that it is not a debatable matter at all. The small organization where the personal touch goes right through may not need a works committee, whereas a large organization does.

The other thing, which will again perhaps be thought rather a small point, is the one you raise about being sub-consciously aware of something going wrong. I have had a certain amount of experience of production work, and I quite agree it does happen at these odd times, when you are shaving for example, that you think "What about so-and-so?" I put it down to this, that in a big organization—I do not know how it is in a small organization—your mind has to have a photographic image of all the jobs on your books, and somehow you suddenly realize that there is a certain job you have not looked at for a certain time. I know exactly what you are referring to, and after a point coming to my mind in this way I have rushed to it as soon as I got to the works, and every time you do that, you are lucky if you are just in time.

MR. ROSE: I appreciate Mr. Sykes' attitude towards the smaller concerns, shall we say of the 100 to 250 employee type. I often quote these figures because I feel that a misapprehension exists as to the average size of an industrial concern. The most important group is that of the smaller firm just in its hey-day—about fifteen to twenty years old, where there is still a great deal of the old "personal" management left. If you read books on management you will find there is always a stage at which the author says, "Up to this point industry was a personal affair between the employer and his workpeople, but the introduction of the joint stock company has led to the complete anonymity of industry, and now the owners



of the business are the shareholders." It is true that the shareholders are the owners, but they do not manage the business. There are many concerns where the managing director to-day may only have a small shareholding, but he is a sort of father to the whole of the staff, as perhaps his grandfather was, who actually owned a business of the same size. Where a man who is the managing director accepts and cultivates the idea that he is the central pivot, responsible for the safety and welfare of the business, you will find a stability in the business which carries it through many difficulties.

Inspectors, I know, are often people who reject things. Before the war we were doing some 7.5 in. shells for the Greek Government, and a Greek gunnery lieutenant came to inspect the shell. The drawing was placed before him—it was one of the good old-fashioned linen drawings, and he looked at this and said, "Where are the gauges?" . . . We gave him the profile gauges, which he laid on the plan; the latter, having been coloured, had stretched and the gauges naturally did not fit, so the inspector immediately refused to accept the gauges. The head of our inspection department, who was experienced in dealing with inspectors of every nationality, said, "I think there must have been a mistake; they must have given us the wrong plan," and as it was nearly lunch-time he took the Greek officer into the town for lunch. In the meantime we sent the profile gauges up to the drawing office and drew another plan round the gauges. When he came back, after a very good lunch, the plan exactly fitted the gauges, and all was well.

With regard to progressing, I do not believe that until the last trump sounds we shall ever get on without the progress man. I know there are very highly tuned production control offices where they profess to organize everything from a central point, and no progress men are allowed, but quite frankly, I do not believe it is possible to organize the flow of parts so smoothly through the shops that nothing will ever go wrong. You know as well as I do that one never knows what is going to happen. You can lay your plans, but something will go wrong. If you depend upon a reasonably efficient human being you will get along more efficiently, in my opinion, than if you depend upon a system. I would never accept, however expert and important the authority was, the fact that a system run from a central office outwards was 100% efficient in actual fact, whatever it may appear to be on the surface.

With regard to Capt. Sargeant's remarks, he rather misunderstood me with regard to works committees. I did not say that the works committees were a debatable point, but that the best method of managing a canteen was a debatable point. I am very strongly in favour of works committees, which are an excellent way of getting people together to discuss matters which are of general interest both to the management and to the operatives.

With regard to Capt. Sargeant's remark that nothing can be allowed to run by itself without being watched, I used to reckon 70 per cent. of the stuff that was going through could be allowed to run more or less on its own : 25 per cent. wanted watching, and the other 5 per cent. you simply had to fight like wild-cats. There are always a number of things to watch, and if I were a senior wrangler I dare say I could get at it through the science of probabilities.

MR. F. GROVER (Section President) : The lecturer has interested me exceedingly because I began as an employer of six men and a boy, and my planning department consisted of a sheet of drawing paper and a pencil. From those small beginnings it has been very interesting to me to notice how the developments in the works that I started some thirty-five or forty years ago have grown so that they are now using many of the forms of management which we have had described to us to-night. There has been a development which has in some measure forced itself upon the management. I do not say that we are perfect in the methods we are now following, but it is satisfactory to note that we have developed along very similar lines to those described to us to-night.

VISITOR : Mr. Rose placed the stores under the control of the works manager. It is often stated that the stores should be under the control of either the purchasing or the accounts section. Regarding maintenance, a fitter millwright is put forward as doing maintenance work and reporting weekly or at other periods to the works manager. It seems to me that the one in charge of maintenance should be rather above the class of a fitter. He should be in touch with developments in machines and processes and should have access to technical magazines and other sources of information. The ordinary fitter, skilled though he may be, tends rather to put a machine back into its original condition, whereas very often there are occasions when the machine should be radically changed, such as chain drives being replaced by pulleys.

MR. ROSE : With regard to your point about the stores being under the control of the purchasing or the accounts. In a small business, of course, such an enormous amount depends on the personality of the people concerned. I can quite conceive an accountant being an admirable person under whom to put the stores. In fact, one of the most efficient stores I ever had anything to do with was obtained by taking the stores away from the works manager and putting it under the accountant, who was interested, and who had had a good deal of shop experience. The same applies to the purchasing side. You might get a buyer with a definite sense of organization and interested in the shops, who would be an excellent person to put the stores under if the works manager was too busy to bother with the stores, which is the attitude of some works managers. With regard to maintenance and the improvement of

the machinery, I quite agree, but again it is a question of choosing the right type of fitter. I have met fitters who were quite good enough to do that, and who took an interest in reading magazines, and were quite prepared to put up excellent suggestions and designs of their own. Again it is the personality that matters. That is really one of the difficulties of discussing this kind of management problem. So much depends on the personality. There are arrangements which in many cases will work satisfactorily, but which one would hesitate to recommend in a book.

VISITOR: In your paper you emphasize the importance of planning. Supposing that the products of a firm are of such a nature that it is very difficult indeed to anticipate what the sales are likely to be, because their popularity or otherwise cannot accurately be estimated. Therefore, in the initial stages small quantities are purchased. Subsequently the demand begins to grow and larger quantities are put through and the demand continues to increase for a few years. Then a downward tendency commences. What, in your opinion, constitutes the best method to adopt in relation to production—the keeping of records of sales, monthly or bi-monthly, and before launching new stock orders detail these sales and order on the average, or do you advocate little and often, when cost falls according to the production or the quantity which you put through?

MR. ROSE: You are putting a very broad point, because finance enters into it as well. If the firm has ample finance available and is not worried about increasing stocks, it is easier to anticipate sales. Then again it depends upon the type of product, when the economic stock figure is being determined. There may be occasions when it is possible to manufacture the whole year's requirements of a small component as long as there is not a large amount of capital involved. You say the sales start in a small way and gradually grow up, and then after a little while there is a falling off. The first thing the sales manager would do would probably be to have an analysis made, and so find which particular item was falling off. When the demand starts dropping he would see the fact from his monthly figures, and, if it was not a seasonal falling off, after the drop had been spotted for a month or two the sales manager would have to get down to it and find out the specific cause of the fall; whether it was due to a competitor, or whether a new process had been got out by someone else which had put his own goods into obsolescence.

VISITOR: I would like to know in a general way if it is not a fact that there are such a large number of small firms because they are able to carry on their works with a minimum of non-productive labour, as against firms having a larger number of workpeople and requiring a much larger number of men for non-productive work.

MR. ROSE : Indirect labour is necessary to run the direct labour efficiency. There is not a person as a non-productive individual in an industrial undertaking, or, if there is, he ought to be making tracks for the door ! There are direct workers, and indirect workers who are assisting the direct workers to do their jobs efficiently, and there must be an adequate number of indirect in proportion to the direct workers, otherwise you will obstruct your direct workers and lose much more money than is represented by the wages of an adequate number of indirect workers. Sometimes I come across managing directors who object strenuously to having an extra clerk in the shops. In a theatre the only direct workers are the players on the stage ; the indirect workers are the attendants, the scene-shifters, the programme sellers, and so on. You must have service if a theatre is to be run efficiently, and in industry the old idea of " Let us see how much we are paying for non-productive labour and cut 25% off it to economise " is childish, and ought to be broken down by now with our modern ideas of management. It is up to the managing director or the works manager to ask " What is the minimum ratio between one and the other to give me efficient service ? "

It amuses me to go round sometimes with a managing director and say, " Your foreman seems to be doing a lot of clerical work." " Yes, I do not believe in wasting money on clerks and non-productive labour." " How much do you pay your foreman ? " " £5 a week." " Would you like to see a fitter doing a boy's job ? A foreman should do a foreman's job why take a £5 a week man and get him to do a £2 a week job ? Someone must do the work, so in order to economise you put the most expensive man in the shop on the cheapest job in the shop. It does not sound logic to me."

VISITOR : It may be that there are a number of firms, possibly of the 1-50 employee type, where non-productive men are not required. For instance, there is no necessity to have progress or time study men in factories employing up to 100 workpeople.

MR. ROSE : It depends on what you are making. If you were making soap you would have a different organization than if you had 100 people in an engineering works making small parts.

MR. J. HORN : Mr. Rose has dealt with management of a works with 250 to 300 workpeople and as the works with which I am engaged has about 300 men it has been particularly interesting, but I am afraid I cannot find much material with which to cross swords with Mr. Rose, as we run our organization on very much the same lines as Mr. Rose has enumerated.

Regarding the earlier remarks of Mr. Sykes as to whether Mr. Rose had any suggestions to help the progress people, I may be able to offer a few suggestions that may help, as we have found the following to be extremely useful. Close co-operation is essential between

the drawing office and the works regarding the issue of part lists. It has been found necessary to issue these lists in sub-assembly order, and in the order they are required by the fitters, and still further have the sub-assembly number on the prints. This helps the progress to collect the parts into small batches ready for issue in the required rotation.

When the lists are received in the machine shop further segregation takes place and lists have been tabulated which concern the various sections of the machine shop. For example, lists of parts with first operation on the 1.1/4 capstan lathes, mostly mild steel work, lists of larger parts produced on turret lathes, lists of mild steel and castings with their operations on the milling machines. When the foreman gives out each job to the first operations all he does is put his pencil through each item, as an indication that that particular item has been dealt with. It also helps the foreman to do his job in an orderly manner by sorting out the jobs of like diameters etc. to save setting time, and start the items with the most operations first.

Other lists are got out for the benefit of the man in charge of the castings accumulation, all matter such as steel work and commercial parts being deleted. These are again arranged in order of material, C.I., M.I., Phos. Bronze, and so on, and it is his job to see that castings accumulate for the next batch ready for issue in the machine shop, putting the completed numbers in bogeys ready for issue, and the uncompleted parts in special squares to await the making up quantities. By this method we find the progress staff helped considerably as each foreman is familiar with the part not on production, and takes the necessary steps to get the lagging parts going as quickly as possible.

Of course, the progress office keeps a thorough progress of each batch and details of each operation for later use. The whole object is to get the parts moving at the very beginning and they will automatically find their way through the shop if the rest of the organization is sound, and the progress people have been helped considerably.

I was very interested with regard to the indexing of repairs to machine tools. It is always worth while knowing exactly what a particular tool has cost in maintenance when consideration is being given in connection with further additions to plant.

**MR. ROSE :** I can assure you that the card index is of special value when you want a new machine. If you go to your chief and say it is about time you had a new machine, he may say " Rubbish." If you can produce a card showing how much you have spent on repairs for the past year on that machine it may mean that he orders a new machine straight-away !

**VISITOR :** Mr. Rose emphasised that no system was 100%

## WORKS MANAGEMENT IN A SMALL FACTORY

efficient. Most of us know that, because small details prevent systems being 100% efficient. The real problems are tool breakdown and inefficient workmanship, and, probably most important of all, the fear of sheltering the person responsible for a breakdown.

MR. ROSE : When I am trying to put a system into a factory I try to find out what is the line of least resistance—what is the easiest thing to do—and then direct the system I am putting in along those lines of least resistance, so that it is as easy as possible to work the system correctly. You can start with a cast-iron system which you force into the place, but you will never do much good that way. It is very instructive if you have a look round the forms in your own works, and see how many of the columns in those forms are being filled out. Seldom much more than 25% of any document which is a printed form is really being made out. I do not know why it is—perhaps human nature. People who go in for management organization work seem sometimes to feel that it is one up to them if they can put in a complicated system. It is really the other way round. The more complicated the system is the more probability there is that it will not work. With some systems when something goes wrong great harm is done because that fact is not made known soon enough.

VISITOR : I wonder whether Mr. Rose could give us a definition of efficiency of a factory, and how it could be measured. From the shareholders point of view I suppose the efficiency of the factory is measured in the terms of the profit, if any, but it may be that due to the installation of up-to-date management systems the efficiency has increased, but the profits may have decreased. For example, a system of paying by results may have been introduced but how can we determine whether that system is justifying itself, particularly in a factory manufacturing a variety of products? How can we determine which is the most efficient section of the works or the most unremunerative product being manufactured? Should we curtail the manufacture of one article and increase the manufacture of another? To simplify my question, how would you determine the efficiency of a factory?

MR. ROSE : I rather doubt whether there is any formula by which you can determine the efficiency of an undertaking as a whole. There is a standard which I quoted, and which is accepted rather in a broad sense, that an industrial undertaking should be able to make 12½% on its net worth. If I were asked to go into a factory and say whether it was working efficiently or not, I should say that one can sense, not of course the efficiency figures, but an efficiency feeling, which gives one the first idea as to whether the place is running efficiently or not. You can, of course, set up certain standards of your own by ascertaining what is happening at the moment,

and then trying to improve on it, say by taking the output per £1 of direct labour or output per section. Then if you have returns of some kind weekly or monthly from all departments it is not very difficult to find some method of measurement. It may be that two or three cross-connected returns will enable you to see whether you are bettering the position or not. I do not think there is any real method of measuring the efficiency of an undertaking as a whole. You can measure parts of it, but it is difficult to compare efficiencies between one undertaking and another, as circumstances are so variable.



## THE MODERN TOOL ROOM AND ITS RELATION TO PRODUCTION.

*Paper presented to the Institution, Preston Section,  
by W. Wilcock, M.I.P.E.*

THE tool room in the past has often been considered as a kind of industrial boil, which gave the management and the shops "a pain in the neck." A section, having existence under such circumstances, was of necessity housed under conditions and environment in keeping with such thoughts. Consequently, most tool rooms were found to be in some obscure dark and dismal corner of the shops, and equipped with machine tools of doubtful condition, usually old, decrepit plant thrown out of the production machine shops.

Nowadays, I am pleased to say, the people who were mainly responsible for such a state of affairs have slowly but surely changed in their outlook, forced by the realisation that an efficient tool room is a definite economic advantage, and instead of thinking this department only existed to hold up production, and keep itself in a job, it is now considered to be the very main spring or artery of the production shops.

The tool room should be situated in a central position in relation to the machine shops, so that all its servicing can be done in the shortest time possible. Adjacent to it should be the main tool and jig stores, as this is a great asset to both the tool room and the machine shops, because any difficulties on problems of jigs and tools are in direct contact with the tool room experts. Many times the sudden changes in materials, the stiffening up of materials, cause difficulties in the shops, but if they have the advantage of being straight against the tool stores, the troubles can be very carefully investigated.

The functions of the toolroom depend to a large extent on the size of the factory, coupled with the type of work that the factory is engaged upon, and I propose, for this evening's discussion, to take a factory of average dimensions, not a small-type jobbing shop or a large mass production factory, and so we will assume that the product is of medium size with plant somewhat near the following capacity: centre lathes 12 in. by 60 in. capstan lathes, bar lathes, combination lathes with chucking capacities from 6 in. to 24 in., multi-spindle and single spindle automatics, along with an average supply of grinding machines, external and internal drilling machines,

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*Preston, 16 March, 1938.*

milling machines, etc. I think that capacity does really cover about the average size of manufactured product of the average machine shop. I mentioned chucking capacity from 6 in. to 24 in.—that covers a medium sized range without getting into very heavy material.

Having formed some opinion of the size of the factory and fixed on the situation of the tool room, let us proceed to equip it with plant of a suitable nature. I would lay down, here, that the plant must have a capacity capable of dealing with the largest jig castings it will be called upon to produce, so it will be seen that the size and type of the factory's product has a direct bearing on the equipment of the tool room. The following is a list recommended for the size of factory we are considering :—

- One—high speed planing machine.
- Three—vertical milling machines.
- Two—horizontal milling machines.
- Two—horizontal universal milling machines.
- One—vertical grinding machine. (36 in. capacity).
- Three—horizontal peripheral grinders.
- Three—external grinders.
- Two—internal grinders.
- One—gauge lapping machine.
- One—horizontal boring machine.
- Two—radial drills.
- One—pillar drill.
- Two—sensitive pillar drills.
- One—fin drill.
- One—jig boring machine.
- Six—lathes from 6 in. to 24 in. capacity.
- Two—all ground gear head tool room lathes. (Fitted with taper turning and precision screwing attachments.)

We also need a gauge room, equipped with a full set of high class measuring instruments capable of measuring to .00001 in. controlled by the Johansson type of blocks, a shadowgraph capable of 50 magnifications and complete sets of master gauges for internal, external and screw thread measurement.

Necessary, too, is a high speed steel hardening plant, and equipment for the tipping of tungsten carbide tools and the grinding and lapping plant necessary for finishing these tools, and we must not forget a small tool stores to supply the needs of tool room personnel. Of the previous mentioned plant, there are some worthy of further enlargement, as for instance the gauge lapping machine. This is now a very important machine tool in the production of snap and caliper gauges. The machine consists of a headstock, having a grinding wheel mounted on one end of the spindle and a cast iron lapping wheel on the other end of the spindle. The cast

iron lapping wheel is finished smooth and true in the lathe and then carborundum is rolled into the diameter and faced by means of a hardened and ground roller usually performed by hand. The resultant finish and flatness given to the production gauges made on this machine are excellent.

The jig boring machine, another very valuable acquisition to the modern tool room, as almost any shape and size of drilling jig can be produced without any marking out, and give jig bored bush holes to .0002 tolerance on both pitch and chordal dimensions. The times, of course, vary according to the size and shape, etc., of the jig, but the work is produced accurately and speedily so that it is economical to provide ring jigs for even small batches of production parts.

A ring jig with six holes, 5 in pitch circle  $\frac{7}{8}$  diameter can be produced in about four hours on the jig boring machine, 12 holes  $2\frac{3}{4}$  pitch  $\frac{5}{8}$  diameter holes in six hours. That will give you some idea as to the production speed of these jig boring machines.

The shadowgraph instrument is now another everyday tool and can be found in full use not only for checking of screw thread and gear tooth forms, but for the manufacture of all kinds of profile gauges such as intricate and difficult form tool gauges used in the production of such tools in the tool room. Those circular form turning tools used in the automatics can be produced much easier and speedier by the preparation, by the jig and tool office, of enlarged drawings of the desired shape to 25 or 50 magnifications, and the tool is ground up to coincide with this drawing.

In the matter of organisation of the tool room, I suggest that the department be divided up into sections as follows :—

(1) All machining would be under the control and direction of a high class machinist who must have a good sense of production methods, coupled with a first consideration for accuracy and class work, taking over, also, the small tool manufacturing machines, cutter and gauge machines, including lapping, also a small marking out staff.

(2) The fitting side of the tool room requires a competent man to control and direct the sections of this work, which I suggest would be split up into sub-sections as follows :—

- (a) The manufacture of new jigs and tools and press tools ;
- (b) the repair and renewal of jigs and press tools ; (c) the repair and maintenance of tools and gauges ; (d) the hardening section ; (e) the tungsten carbide tool section.

Before the jig drawings are released to the tool room for manufacture they should be scrutinised by a competent planning engineer with a first class knowledge of jig and tool manufacture, who would prepare a manufacturing process sheet, and if this is issued to the new jig section, as separate entirely from the other sections, I have

no doubt at all that this work can proceed on piece work lines with every chance of success. It has been my experience to have adopted this method some years ago, and can personally vouch to piece work times being quite a workable proposition in the manufacture of new jigs, but to ensure complete success, repair and maintenance work must definitely be kept away from this section. Immediately in our minds there arises the thought of slipshod work by operators to increase piece-work earnings, but I am of the opinion that if all jigs are tested in the tool room and the samples put up to the production inspection, this overcomes the desire to rush the work and sacrifice accuracy. But I would also like to emphasise that the inspection should not be attached to or under the control of the tool side of the business, and to commend in every way the testing of jigs in or by the tool room staff, as I am sure the information gained, such as swarf problems, clearness, ease of operation and time studies, is of first rate importance, and the data gained is useful to the jig draughtsman and the ratefixer as foundations for future reference.

There is another important section which should be attached to the tool room, I refer to a small staff of high class tool setters, whose duty would be to take over every new machine tool introduced into the factory so that tool set-ups and layouts can be tested and tried out before the machine goes on its long stretch of production life.

It has been found that on numerous occasions extremely useful information and data has been compiled by this side of the tool room's activities, with regard to the practical efficiency of any particular set-up, and I think you will agree with me when I say that no matter how careful and painstaking the jig draughtsman may be on the board, there are times when problems and snags arise in the practical operating of tool set-ups that can only be dealt with on the spot, which calls for the attention of a skilled man with a sound knowledge of the requirements, for within his scope come such points as to whether more tools can be brought into operation on one turret face or not, or if the cutting lubricant is satisfactory for volume or otherwise, or proper attention has been given to the swarf, or in other words if the swarf is coming off correctly in small pieces or in long ribbons or coils which choke up the cam mechanism and interfere with the production. He can also arrange for the set-ups to be kept together in containers, and generally his life is full of interest, going from one improvement in methods to another.

If I might stray from my subject for just a moment. I put it to you that without question here are to be found the right type of men to shoulder the responsibility of the foreman or supervisor at a later date, particularly if some care is taken in the selection of the men at the outset, and I do stress the point that there is not another section in any engineering works that caters so well for the training of the future executive with all the backing of the modern

tool room and methods of production at his finger tips, and I would like to see this section fully exploited.

This section of the tool room is definitely of very great value, not only in keeping your machine tools up to the highest possible standard of efficiency, but at the same time you have what I should say a perfect training ground for future members of any executive you care to call upon. They are being trained in the very work and knowledge which you would call for if you wanted a man to take over any particular machine shop. They are constantly in touch with the latest possible machine tools and the latest methods not only of this country but of Europe and America. If these men are of the right type, they are really smart intelligent young men. There is no doubt you have not a finer school room for training them than putting them in a section of this kind. I think that is what the machine tool trade and the tool side of engineering has suffered from for a long time.

I would now like to say a few words about the methods to be recommended for the manufacture of jigs, etc.

In my earlier remarks I mentioned that a planning sheet should be sent along with the jig drawing, whose object should be to so set out the work on the jigs that the castings and the steel work can all be machined before it is handled on to the tool fitter for final assembly, and the main factor in ensuring the success of this method is to centre this work around a small marking out staff, this you will remember I mentioned in my sections of the tool room, this being attached to the machining side. These duties would be to take over the raw material which goes to make a jig, castings, forgings, bar material, etc. In conjunction with the machining supervisor all the turning and milling would be allocated. The castings would be set out and forwarded to the planner or borer. As the jig bushes, clamps, and setting pieces are completed from the various machine operations he would set them out or stamp them and forward to the hardening plant and finally all the parts would return to this section for checking purposes. On completion, the markers out would notify the fitting supervisor that a complete unit was ready for assembly or fitting.

If you adopt this principle that all setting out on your jig parts is performed by this staff, you will increase your output and definitely decrease your cost of jig making.

If we can only carry our minds back a few years when the jig was put in the tool room oftener than not and the drawing given to the tool fitter who had to pick out the castings, etc., and then start off marking out, drilling, shaping, slotting, and all the various operations necessary to complete a jig-well, I can assure you gentlemen, that by splitting up or sectionalising the methods of production of jigs, which is now done on the same lines as in the production

shops, by doing that you can produce jigs very cheaply indeed and very efficiently. This is because the operations are not performed by a man supposed to know a little bit about everything, but by men constantly doing certain operations, whether milling, drilling or grinding. They are all experts in their own particular line. This goes to ensure a better jig when finally completed. The whole collection of components in the department go as a complete unit of assembly to the tool fitter. If a jig is produced on these lines, it is going to cheapen it considerably.

We have now considered the manufacture of our jigs and tools, and perhaps we could turn with advantage to the main distributary centre for the jigs and tools. As previously mentioned, it should be close to the tool room, but it must definitely be situated in a central position in relation to the production shops, and should the production shops be rather scattered, small subsidiary stores in suitable positions are sound practice, having them serviced by and responsible to the main stores. One of the chief aims of this tool stores should be to keep down the losses of machining hours in production plant to a minimum, which can only be accomplished by the holding of necessary stocks of tools to cover all normal emergencies.

It is necessary that the tool stores is equipped with suitable plant capable of dealing with any and every class of tool sharpening within the capacity of the stores, and I would suggest the following machine tools as essentials :—

(i) Grinder equipped with optical gauges. I do not know whether any of you have handled the Zeiss optical twist drill tester. I have found it a very valuable instrument. A man with very little skill can mind the drill perfectly. The drill definitely controls grinding of the web of the twist drill. It guarantees or ensures to the twist drill grinder that the centre of the web is definitely in the centre of the twist drill, both at right angles to the web and in the opposite direction. It is a very fine instrument.

(ii) I should also include a tap sharpening machine. This machine is very valuable in any tool room, and the work can be done by a man of very little knowledge.

(iii) Tungsten carbide Lapping and honing machine. It is not very often that you have your tungsten carbide tools badly chipped, unless you are operating on some of the modern cast irons. The average tungsten carbide tool suffers more from abrasion than anything else and becomes dull or blunt. The edge of the tungsten carbide tool must definitely be as fine as it is possible to produce it.

There should also be sections for tool inspection, jig inspection and gauge inspection. These are extremely valuable, as it would be possible for operators to return tools to the stores, and probably the storekeeper, not being a competent tool maker, may not take notice of the cutting edges of the tool. The tool may possibly

find its way into one of the bins. Next time the tools are required they will be blunt to begin with, hence putting charges on set-up times. The same applies to the inspection of jigs. It is certainly important that some class of jig inspection does take place. May be a driller has been using one, and he has used hammers or spanners—you would soon find that your dimensions of the ring jig are losing their accuracy.

The same words apply to gauge inspection. We follow out a system of gauge inspection whereby every gauge in the factory is inspected once every six or seven days. Attached to each gauge is a history card which must have the gauge inspector's initials and the date when he last examined it. This is of very great importance particularly if you are working to very fine tolerances. It is of very great importance that these gauges do pass through the gauge inspection room once in a very short period. The components will have to be scraped or filed.

It is important that a good system should operate in the stores for the issue of jigs and tools, and I would here say that in my experience the brass check system is very effective, which briefly is as follows:—

The operators are each supplied with a number of round brass checks on which is stamped his check or factory number. In the stores are boards with the full range of employees' numbers printed thereon, having hooks to each number. Each bin is numbered and supplied with a series of hooks, on which are square brass checks covering each tool in that bin. In the bins there is a hook in the side which will carry a certain number of brass tallies and each tally is stamped with the number of the tool in the bin. Immediately I present my check at the stores window, it is hung on the hook, and a tally is put on the check board.

As an example, let us take an operator requiring a twist drill, drill socket, tap, tapping chuck, and screw thread gauge—five tools in all. He would present his jig and tool card giving size and number of each tool at the service counter of the stores, along with five of his numbered brass tool checks. The storekeeper then finds the location of the desired tools, takes out the tool and removes from the hook on the bin the square check for that tool, replacing it by the operators' numbered check. The five square checks with the tool numbers on are then placed on the master board against the check number of the operator taking them out, and so a complete check on all tools is easily obtained. There is, of course, the time when an operator of a machine using a complete set-up requires all these tools at once, and in this case one check is sufficient to withdraw the complete set of tools in a special container.

You will remember earlier that I mentioned the tool setters would in their duties have containers in which to put the complete set-up,



say, off the combination lathe, like No. 10, and would use a large number of tools only special to that particular operation. You can quite see that the operator would be making a call for possibly in the teens or over 20 tools along with the gauges. You could not provide the fellow with a bag full of checks—you would defeat the object of the system. The thing to do is to number the set-up—give the whole set a number. This I have found extremely useful. Not only give it a number but provide a kind of pictorial print showing each face of the turret, all the tools used on each face, and in the right hand column of the print the feeds and speeds and the particulars of the requisite gauges necessary for performing the operation. That is a point which I omitted to mention during the tool setter's duties. If, during their duties, there is an alteration in tool set up, they are able to make the necessary alterations or modifications on the prints, thereby keeping the whole of the tooling organisation up to, shall we say, the last word of efficiency. Say there is an alteration in material from the original set-up and they find they can increase the feeds and speeds, the change takes place, and the record is kept on the print. It does not matter if the operator has to be transferred into some other section, the one who takes his place has the full information in front of him.

In conclusion, I would say I have not mentioned the "paper side" of the tool room organisation. This is, of course, a necessary part of the work, but there are probably varied ideas as to the best methods of keeping track of the cost of manufacture, and I would say that most systems have separate claims of their own, and that a good sensible clerk would work any of them to the satisfaction of the costing department, and, therefore, I do not propose to dwell on that side of the question, but I have with me examples of a system in use for the controlling, ordering, and issuing of jig castings, steel bar and the necessary rough material, which I will project on the screen as a matter of interest.

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